

THE EXTRACTION OF TEETH

J. H. GIBBS

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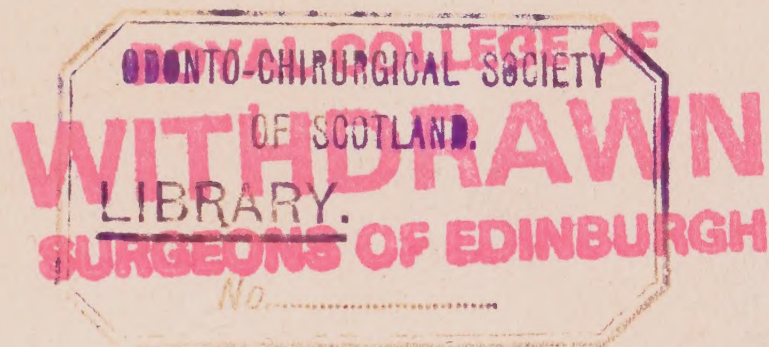
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EXTRACTION OF TEETH

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BY

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PREFACE

THE only justification for adding still another to the list of books upon the extraction of teeth is that the author has something new to say.

No progress has ever been made by orthodoxy, and it is my deep conviction that the orthodox methods of extracting teeth are wrong in principle and bad in practice that has induced me to consent to give a wider publicity to my own heterodox views.

For some years past, a number of Colonial and American dental graduates have been coming to Edinburgh for a few months for special instruction in Anæsthesia and Extractions, and they and many medical practitioners who have attended my Department at the Royal Infirmary, have expressed the wish that I would write a book embodying my teaching, and, so far as it is possible, describing the technique.

The task has been more arduous than I anticipated. The book has been written and re-written at odd moments during the past five years, and had it not been for the great help afforded by my wife in revising and correcting the manuscript, it would never have been completed.

The operative technique has been illustrated by a number of original photographs, in the hope that they will elucidate any obscurity in the text. There are also photographs of specimens, which are from my own collection, unless otherwise stated.

The book contains very few references to the literature of the subject, and although a bibliography was drawn up, it was decided not to publish it, the reason being that my object is simply to describe the technique that I have found eminently successful, and not to describe all the different methods and instruments

that have been recommended for the extraction of teeth, many of which I have put to the test of practical experience.

Messrs C. Ash, Sons & Co. Ltd. have kindly lent blocks to illustrate instruments, and as I have recommended their forceps, it is only fair to them and to myself to say that I derive no pecuniary benefit from the sale of any of the instruments and that I am not even a shareholder in the firm.

My best thanks are due to my secretary, Miss King, for a great deal of help, especially with the photographs ; to the publishers, Messrs E. & S. Livingstone ; to the artist, Mr Cathie ; to the lithographers, Messrs Hislop and Day ; and to Dr A. Walker for the pains he has taken in seeing the book through the press.

EDINBURGH, *September* 1912.

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EXTRACTION OF TEETH

CHAPTER I

INSTRUMENTS

THE instruments necessary for the actual extraction of teeth are few in number and are of the nature of forceps or elevators, but besides these, other instruments and appliances are often required, such as props, mouth opener, gag, sponges, jaconet, towels, tracheotomy knife, gum scissors and dissecting forceps.

In spite of the number and diversity of forceps recommended by various teachers, and figured in catalogues, one finds as a matter of experience that only two are necessary—viz. one pair for the removal of the maxillary teeth, and another for the mandibular.

The exact pattern of forceps recommended in these pages has been gradually evolved from the very large experience obtained by my colleague, Mr William Guy, F.R.C.S.Ed., and myself at the Royal Infirmary and the Dental Hospital, Edinburgh; and I wish to express here my great indebtedness to Mr Guy for the central idea of the two forceps and for the general principles governing their use. Very

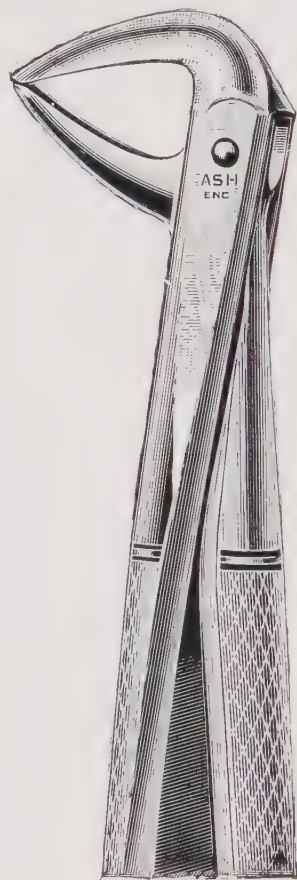


FIG. 2
137 (Lower)

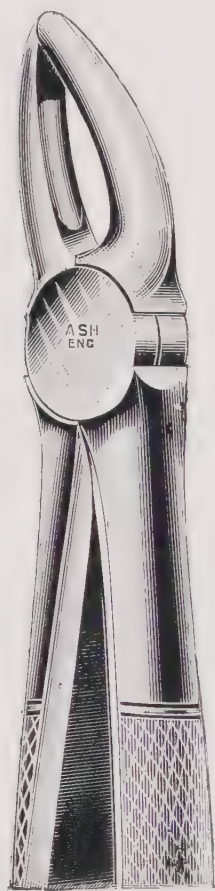


FIG. 1
136 (Upper)

much of the success of the methods advocated depends upon the exactness with which these instruments, which are of necessity hand-made, conform to the pattern.¹

The **forceps** (figs. 1 and 2, Nos. 136 (Upper) and 137 (Lower)) must

¹ In my experience Messrs Ash, Sons & Co. can be best relied upon to produce these instruments true to the pattern.

on no account be nickel-plated. This applies more particularly to the upper forceps. When there is a very difficult extraction to be done, one needs all the aid available, and the heat and perspiration of the hand, to say nothing of the lubricating effect of mucus and blood, render the instrument all too slippery, and this is greatly aggravated by nickel-plating. The makers give a black coating to the handles, which is apt to soil the hand for the first few times of use; but it may be removed at once by boiling the forceps in a solution of soda. Another essential is that the joint of the forceps, whilst not allowing side play, should work without friction. If the forceps are held horizontally with one handle uppermost, the lower handle should drop freely by its own weight to the full extent allowed by the joint. Any stiffness can be removed by working a little fine pumice powder and oil into the joint, and then removing these by manipulating the joint in boiling water.

A pair of lower forceps often outlasts three or four pairs of upper ones, the blades of which in time become so mutilated as to be inefficient. An operator should never use any instrument in such a state as to make him feel justified in blaming it rather than himself for any untoward incident occurring during the operation.



FIG. 3
23 and 24
(Right and Left)

In the case of **elevators** the pattern is not so essential as in the case of the forceps. They should, however, be right and left. The instruments recommended are shown in fig. 3 (Nos. 23 and 24). They are easily dried by drawing a towel right through the handles. Although I have in bygone days used the straight elevator, and still see it used, there is no need whatever for such an instrument in the routine extraction of teeth, and I am strongly of the opinion that its use should have been abandoned long ago.

The cutting edges of the blades of the forceps, as well as of the elevators, should be constantly examined to see that they are sharp and not turned over. Should they need sharpening, use a hard stone such as Arkansas, preceded, if necessary, by a fine file. All the sharpening must be done at the expense of the outer side of the blades, and great care taken not to remove any more than is absolutely necessary. Any filing of the inner

sides, by altering the curvature, ruins the forceps and renders them useless.

Two other pairs of forceps may occasionally be needed, perhaps once in two or three years, for removal of a buried root, where the crowns of the teeth on each side of it have come so close together that they would be damaged by the forceps in general use. An expert extractor can quite well use the lower forceps for an upper root, and so the one represented in fig. 4 (74N) is sufficient, but it is better to have its fellow for maxillary roots, No. 147 (fig. 5).



FIG. 4
74N



FIG. 5
147

It is well to have four **mouth props**, and none are better than a modification of the aluminium props designed by Sir Frederic Hewitt. The experience of several years has proved that these props are equally efficacious and secure, if the ends are about half the size of Hewitt's, and mine are $\frac{5}{8}$ " by $\frac{5}{8}$ " and the height corresponds to Hewitt's Nos. 1, 2, 4, 5. Not only are both ends of Hewitt's props greatly reduced in size, but the oblique end is so shaped that for half its length it is parallel to the opposite end. This allows the prop to be equally stable whether placed between the cheek teeth or in its usual place between the incisors.

The modification is shown in fig. 6, and the props are known as Nos. 6, 7, 8, 9.

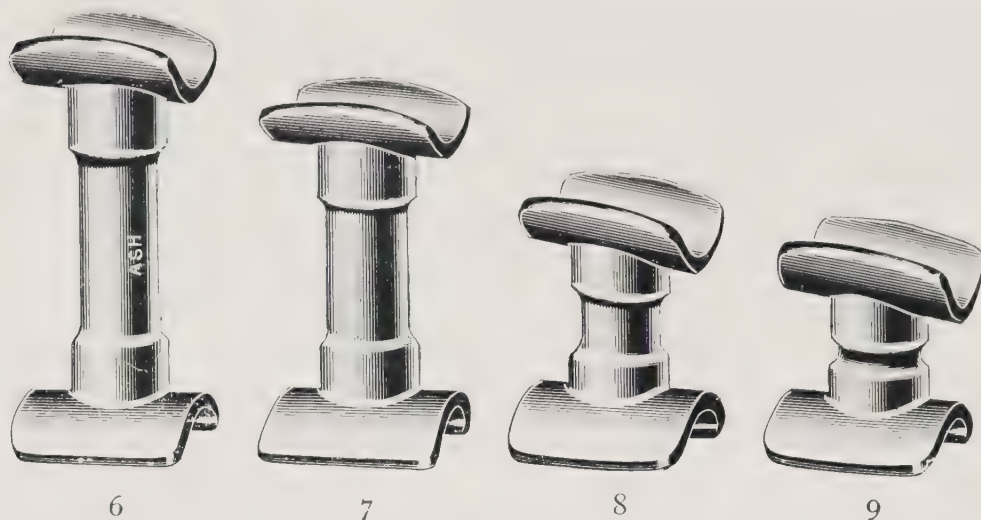


FIG. 6

The rubber pads can also be improved on, both in efficiency and cheapness, by cutting them out of the best red rubber tubing as shown in fig. 7. The one most frequently used is No. 7. The

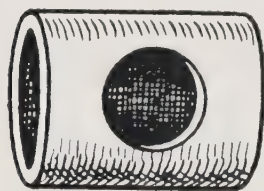


FIG. 7

Rubber pad for mouth props, cut from best quality thick rubber tubing.

props are joined together by a chain, the two larger together, and the two smaller. For those who do not have to carry the props about, a neat and clean method, which appeals to the fastidious patient, is to tie twelve inches of strong white tape to the prop each time it is used, and to cut it off before cleaning the prop.

adjustable gags with the form

At least one **mouth opener** is required and preferably two. In my experience none of the can compare in efficiency and convenience of Fergusson's illustrated in fig. 8, and



FIG. 8

known as No. 3. There is no need to use rubber tubing to protect the teeth, as is usually recommended. The gag

is readily taken to pieces for sterilisation. From a purely operative standpoint, it has three advantages. (1) Its leverage is so great as to open the most rigid mouth with ease. (2) If the handles are kept touching the patient's face and ear, the jaws of the instrument will not slip off the teeth or alveolar ridges. (3) Owing to the strong spring and the arrangement of the adjustable loop, the gag can be instantly released.

In cases where the patient cannot separate the jaws owing to inflammatory infiltration or other causes, or where the patient lets the prop slip from between the teeth, which may then be tightly clenched (as is apt to occur under Chloride of Ethyl anæsthesia), a mouth opener in the true sense of the word is required, and the one in most common use is the screw wedge mouth opener known as No. 1 (fig. 9). There are many variations of this instrument on the market, and many of them are quite

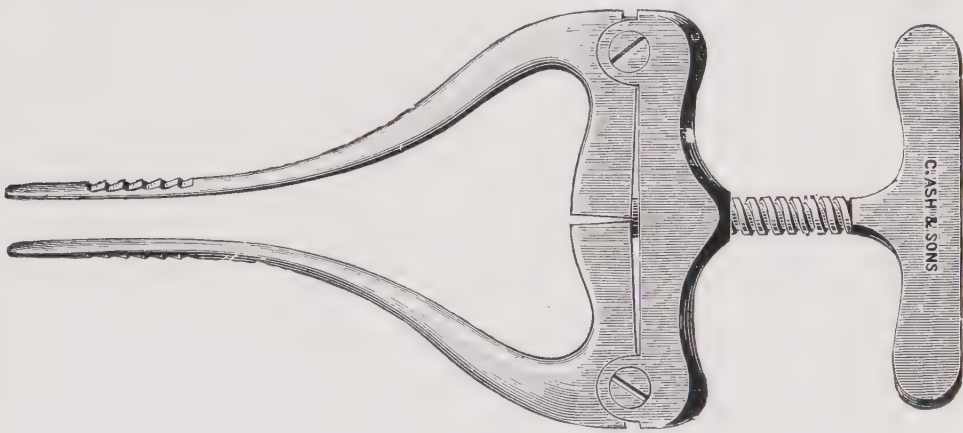


FIG. 9

useless. Two essentials are: (1) The handle which separates the jaws of the instrument must be long enough for the operator to turn the screw with perfect ease, when the teeth are tightly clenched. It must be about as long as the width of the instrument at the base—that is, two and a quarter inches. (2) When the jaws of the instrument are separated an inch at the ends, the last inch or inch and a half must still be converging towards the ends or at least parallel, and not, as is often the case, rapidly diverging. The reason for this proviso is that, if the jaws when separated diverge, the instrument tends to slip further and further into the mouth the more it is opened, and I have seen more than one palate damaged by this happening.

Sponges are of great value in extensive operations; for apart from rendering clear the field of operation, they can be placed so as to make it almost impossible for a tooth or root to pass the fauces, and also by preventing the swallowing of blood, they obviate after-sickness to a large extent. The sponge question

has received too little attention from dentists, and the variety of ideas on the subject is amazing. The sponges chosen should be coarse but compact, so that no pieces are likely to be torn off, and when moistened they should still be firm and elastic. Fig. 10 shows the size and characteristics of a suitable sixpenny sponge. It is a mistake to buy a large sponge and to cut it up, as semi-detached pieces are apt to be torn off during use. One of the great advantages of a sponge is its coarse, rough surface, to which blood-clot clings, thus rendering it easy to keep the mouth clear of blood. For this reason soft or fine-meshed sponges, cotton wool, swabs made of wool surrounded by gauze, and serviettes



FIG. 10

Shows a coarse, compact sponge, the proper size for use.

are unsuitable. Four sponges at least are needed for each operation. **Sponge-holders** of any sort are *quite unnecessary*, owing to the size of sponge used and the technique adopted.

Particular care should be taken that the patient's clothing is not in any way soiled during any part of the procedure. It is truly astonishing with what little concern some dental surgeons ruin a lady's dress, and how calmly the patient herself accepts it as part and parcel of the extraction of a tooth. There is infinitely less objection to being covered with hair-clippings than to have one's clothing soiled with blood, dirty teeth or pus; and yet a dentist, who would deeply resent any neglect on the part of a barber to protect *his* clothing, frequently makes little

or no attempt to protect his patient's. This widespread disregard of ordinary cleanliness is a disgrace to the profession, and the exercise of greater care and consideration could not but raise us in the estimation of the public. Very various are the means adopted to guard the patient, and equally variable the completeness or incompleteness with which they are carried out. Thus it is not uncommon to see a large piece of waterproof material tied so loosely round a patient's neck that the top of it comes nowhere near the field of operation, and the blood and saliva soak in under it! Another variation is to see a little piece of waterproof (reminding one of an infant's bib) tied tightly round the neck, but, as it is possibly less than a foot in width, blood, saliva and teeth flow gaily over it on to the patient's lap. Equally ineffective are the precautions taken by the man who in an off-hand way throws over the patient's chest a serviette, through which the blood soaks immediately on to the clothing. Some dentists are even satisfied with a Johnson's absorbent napkin nine inches square! After an extended experience of many materials, I have found **jaconet** (pink by preference) the cheapest and most efficient. One and a half yards of forty-four inch material are required. It is a common practice to cut out a piece (invariably far too big) from one end, to sew on tapes, and by means of these to tie the material around the patient's neck. Now, considering that blood and saliva as well as water, when washing out the mouth after the operation, trickle in greater or less amount along the patient's skin, it is obvious that this method must prove a failure, as no patient would tolerate the tapes being tied sufficiently tightly to prevent the blood, saliva or water from trickling down his neck, and as a matter of fact I have never seen this attempted.

If a general anæsthetic is to be administered, the patient besides relieving any pressure round the waist, should remove the collar or loosen the neckband. If the operation is a small one, such as the removal of one or two teeth or roots, one edge of a serviette or preferably of a small huckaback towel is turned over the edge of the end of the jaconet, and both together are *tucked in between the patient's singlet and the skin*, the serviette or towel preventing the cold jaconet touching the patient. The jaconet is then spread out so as to cover the arms, shoulders and lap. If the operation is a more extensive one, a thick towel should be used over the jaconet, and both tucked well down inside all the clothing. It is often advisable to make still surer by tucking in a small soft towel round the neck from ear to ear (figs. 26, 27).

If no anæsthetic is to be administered and only one tooth is to be extracted, it is often not necessary to remove the collar.

The edge of the jaconet should be carefully tucked in over it, all round the front, and then the edge of a serviette. The purpose of the huckaback towel is twofold, to act as an absorbent for blood, etc., and as an object on which teeth and roots may be wiped off the blades of the forceps and retained there for examination if need be—the value of this will be explained later.

Tongue forceps are often considered a necessary part of the armamentarium in extracting under a general anæsthetic. They are *quite unnecessary*; for the jaws having been separated by means of a gag, the tongue can be far more effectually pulled forward, by passing the forefinger back to the root of the tongue and hooking it forwards and upwards, than by any tongue forceps.

The following case is instructive. Some time ago I visited the anæsthetic room of a Dental Hospital. Amongst the patients was a young man, to whom nitrous oxide was administered. When the facepiece was removed, the administrator found that the mouth prop had slipped and the patient's jaws were tightly closed. He had been, in my opinion, quite unnecessarily cyanosed, and breathing stopped. The administrator quickly prised open the jaws, at the same time asking for the tongue forceps. They were not to hand, and he hurriedly told a student where they were to be found in the adjoining room. The student rushed off, returning in half-a-minute to say that the forceps were not there. Further directions were shouted to him, and he renewed his search, whilst the patient became progressively blacker, and the enormously swollen tongue protruded further and further through the widely opened mouth. Unable to stand by any longer and see the man die for the want of a pair of tongue forceps, with a hurried apology to the surgeon in charge, I passed my left forefinger into the pharynx, and forcibly hooked the base of the tongue forwards, at the same time vigorously compressing the lower part of the thorax with my right hand. Deep, stertorous respirations immediately followed the removal of the obstruction, and the patient quickly recovered.

The case illustrates how unnecessary tongue forceps are, and how dangerous it is for students to be trained to rely upon having at hand quite unnecessary instruments.

There is, however, urgent necessity for a **knife** suitable for performing laryngotomy or tracheotomy, an instrument which, as a matter of fact, is probably not in readiness once in a thousand times. There is a grave question of responsibility to be considered here, and everyone who extracts teeth, especially under an anæsthetic, should be perfectly clear in his mind on the subject.

It seems to be a very common practice for the dentist, when about to extract teeth from the upper jaw, to tilt the chair well backwards and to throw the patient's head back. This is a dangerous position even with a conscious patient, whilst with an unconscious one it is a hundred times more so; for any object that is loosened, such as tartar, a filling, a fractured crown or a root tends to fall directly into the pharynx, and may as easily

fall or be inspired into the larynx as be swallowed. Even when an extraction is performed under the most favourable circumstances, an accident is possible through a tooth or root flying out of the forceps. When a patient consents to have a tooth removed, whether with or without a general anæsthetic, he, as an ignorant and confiding layman, naturally and quite rightly presumes that a professional man who undertakes such an operation is willing to deal and capable of dealing with any emergency that may arise. Still more does he take it for granted that he is not being thoughtlessly exposed to quite unnecessary risks. Yet what does experience prove to be the case? Why, that after ineffectual and probably purposeless attempts to remove the foreign body from the air passages, the operator rushes off for help, and meantime the patient dies. Imagine any other surgeon undertaking to perform an operation, in which he knows it is possible that a serious emergency may arise at any moment, with the idea at the back of his brain that should the emergency arise, he can run for aid whilst his patient is left to die. Such a state of things is happily inconceivable, and for the sake of suffering humanity let us hope that the time will soon come when the dental surgeon will realise fully the grave responsibility involved in placing a trusting patient in a position fraught with great *possible* risk to life, when he has neither the means nor the courage to attempt the rescue, which to be successful must be immediate. A man, who is not prepared to perform laryngotomy or tracheotomy at a moment's notice, has no right to extract a tooth, at least under a general anæsthetic, unless someone else is present who can do so.

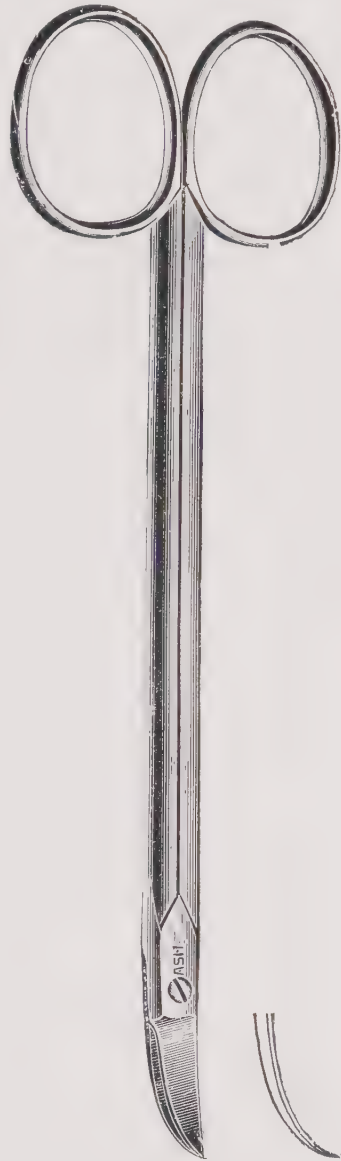


FIG. II

Gum scissors (fig. II) are useful for severing a tag of gum, and **dissecting forceps** for holding it steady whilst doing so. They are also used to set free a tooth from the gum, to which it may be strongly attached even after it has been loosened from its socket.

CHAPTER II

DISINFECTION

THE cleansing of instruments and appliances after the operation may be divided into two parts—firstly, the removal of gross contamination; and secondly, disinfection proper. If the first be thoroughly performed, the second will be a simple matter. Immediately the operation is finished, all instruments, sponges, towels, etc., should be submerged in hot water, so that blood and secretions shall not dry on them. The anæsthetic apparatus should be submerged with the other things, if markedly soiled; but if not, it is left out until the other instruments have had their first wash. The first thing is to wash everything thoroughly with soap and water. To do this, the rubber pads should be removed from the mouth props, and the Fergusson's gag taken to pieces.

The **instruments** should then be vigorously brushed with a sterile nailbrush and soap, special attention being paid to cracks and crevices, and then the metallic instruments boiled for fifteen minutes in water, with half-a-drachm of lysol to the pint. Lysol is preferred to soda, which is commonly used, because soda does not completely prevent discoloration of the instruments, even if they are put into the boiling solution, whilst lysol does, even if they are put in whilst the solution is cold. Instead of boiling them, they can be quite safely sterilised, along with those instruments which from their nature are not suitable for boiling, by immersion for an hour in 2 per cent. lysol, or 5 per cent. phenol solution. In this way the rubber pads of the mouth props, stop-cock, rubber bag and ether dome can be sterilised. When, however, there has been no gross contamination of the anæsthetic apparatus, as in an ordinary nitrous oxide case, it is sufficient to wash it thoroughly with the following soap and hot water :—

Green soap, 20 oz.

Lysol, $\frac{1}{2}$ oz.

Terebene, $1\frac{1}{2}$ oz.

The **facepiece**, however, should have a drachm of lysol poured into it and be turned round and round to let it run into all the crevices. The lysol is then gathered up on a piece of wool held in a pair of tweezers and is swabbed over the pneumatic pad

and the outside of the facepiece. After disinfection, the instruments should be washed in plain water, carefully dried and put away.

The **sponges** are washed out in several changes of water and are then transferred to a small basin of two-per-cent. lysol, in which they lie for twenty-four hours, now and again being squeezed out. Finally, the lysol is squeezed out of them, and they are stored in a wide-mouthed, glass-stoppered bottle, containing one per cent. of formalin in water, so that they are always in a fresh, crisp condition ready for use. They can also be stored indefinitely in five-per-cent. phenol, but they soften and deteriorate in lysol. I have been criticised for using sponges at all, and especially for using them more than once, and I have been asked whether I would use the sponges again, after using them for a patient who was suffering from syphilis. My reply is that, for safety's sake, it is assumed that every patient is suffering from some virulent infection such as syphilis, and that if the sponges are absolutely sterilised, as they are by this method, there is no objection to using them over and over again. I have experimented with many materials as cheap substitutes for sponges, so that they could be thrown away after use, but have not found anything that can compare in efficiency with a good sponge, and as cheap sponges are of no use, the annual cost would be a consideration, if the sponges were thrown away after one use.

The **jaconet** is cleaned by spreading it out rubber side uppermost and flooding it with a two-per-cent. lysol solution, with which and the help of a clean sponge all contamination can be removed. After a quarter of an hour the lysol is dried off and the jaconet hung up to air thoroughly, before being folded up rubber side outwards. Care should be taken not to allow the under side to be soiled, as it is difficult to clean and does not look well. All trace of blood is washed out of the towels at the earliest possible moment with plain water, and after soaking in lysol, they are sent to the laundry.

Of late years most dentists have come to realise the necessity for making some show of sterilising their instruments; but, probably on account of the practical difficulties in the way, it is very rare to meet with any attempt to sterilise the **tumbler**, although it is as likely as anything else to carry infection. After much experimenting, the author has evolved a method which is as simple as it is effective, and actually a time-saver compared with the usual plan of perfunctorily washing the glass and drying it on a much-used towel. Where space is not a consideration and a veritable tank of disinfectant can be used, there is no need for the special apparatus here described, which has been devised

simply owing to the necessity for compactness. It consists of a glass jar $5\frac{1}{2}$ inches high and 4 inches in diameter, with a glass lid, and a "drying" or U-tube 5 inches long and $\frac{1}{2}$ inch in diameter (fig. 12). The U-tube is placed in the jar and steadied by clamping one limb to the side by means of a U-shaped piece of springy german-silver, the other limb being in the middle of the jar. The jar is filled to within half-an-inch of the top of the U-tube with a ten-per-cent. solution of sodii phenas in water.

The tumbler (which for this size of jar should not be more than four inches high) is inverted over the free limb of the U-tube, and so becomes immersed in the disinfectant, except the bottom

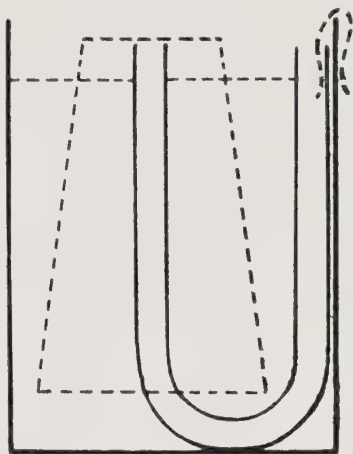


FIG. 12

Section of sterilising jar for tumblers. Shows one limb of the U-tube clamped to the side of the glass jar, the other in the middle of the jar with a tumbler inverted over it.

half-inch, which is of no moment. This arrangement for displacing the air in the tumbler allows of the use of a very small vessel and of a correspondingly small quantity of disinfectant. The method of working is this. Only two tumblers are in use in the surgery, and one is always in the jar, which is kept covered. When a patient comes, the tumbler is taken out but *not dried*, and is filled at once with hot water, and a little sodii phenas added. It is now ready for the patient, and the tumbler that has been used by the previous patient is emptied out, rinsed under the tap, put in the jar and the lid replaced. The reason that sodii phenas is used in preference to some other and possibly more powerful disinfectant is that, as no particular

care is taken to remove the disinfectant from the tumbler, it must be something that has not an unpleasant taste or smell. The formula used is :

Phenol, 20 oz.

Caustic soda (sticks), 3 oz.

Water to 100 oz.

which fills a Winchester quart bottle. The stopper should be smeared with vaseline. Two bottles are made up, and as soon as one is empty, it is recharged and kept until the other one is empty ; the longer it is kept, the pleasanter it is.

In order not to contaminate the drawers into which the forceps, etc., are usually put, the instruments are sterilised immediately

after the operation. When they are about to be used in the dentist's own surgery, they are put into a small dish (a deep half-plate developing dish answers excellently) and covered with disinfectant solution, from which they can be used directly. Otherwise, they can be removed from the disinfectant and laid with the handles towards the operator on one half of a small towel wrung out of disinfectant, and covered from the patient's sight and from contamination by the other half. The technique is practically the same when the operation is performed at the patient's house, as will be explained later on.

One cannot but regret the practice, frequent enough even in this twentieth century, of placing instruments such as mouth mirrors, forceps, etc., in the pocket of the operator's coat, waist-coat or even trousers, or of laying them on a table, bed, chair or floor, or, incredible though it seems, of holding them between the teeth. Such proceedings should be revolting to anyone with ordinary notions of cleanliness, whilst in the case of anyone calling himself a surgeon, they are nothing short of a crime.

With regard to the operator's hands, they should be scrupulously clean, but provided no extraneous pathogenic organisms are introduced, such as those of syphilis, tuberculosis, diphtheria, etc., there is no need for the care that is necessary when about to perform an operation in which strict asepsis is to be maintained during the process of healing. It is sufficient to scrub them thoroughly with a sterile nailbrush and the antiseptic soap, the formula of which has been already given on page 18. The nailbrush should be kept lying in a basin of disinfectant, such as two-per-cent lysol, as it is ridiculous at any time to scrub one's hands with a brush which may be teeming with organisms.

My present choice of lysol for general use as a germicide is the outcome of experiments with a number of disinfectants. Admitting that the discarded drugs are as efficient disinfectants as lysol, I have found that it, more fully than any of the others, meets the many requirements of practice.

CHAPTER III

SURGICAL ANATOMY

SPECIAL consideration will be given to the teeth of the second or "permanent" dentition, as the great bulk of extractions are concerned with these, and moreover they are the ones that involve special difficulties. It will be seen that what applies to the second dentition applies to a very large extent to the teeth of the first, milk or "temporary" dentition.

The teeth are arranged in two arches, the roots being inserted into sockets or alveoli in the alveolar processes of the maxilla and mandible. The means of attachment of the roots to the bone is by a fibrous structure, which has received many names. That probably most used in Britain is "peridental membrane," and the word used to indicate inflammation of it, "periodontitis." Both these words, however, imply that this tissue surrounds the tooth, whereas it is limited to the root and to the distribution of the cementum. Hence the more accurately designed terms in common use in America, "pericementum" and "pericementitis," are much to be preferred. The bundles of fibrous tissue are continued as Sharpey's fibres into the cementum on the one hand and into the bone on the other, and during the extraction of a tooth the fibres are ruptured. This tissue is thickest at the apex of the tooth, where the vessels and nerves enter the pulp canals, and around the neck of the tooth, where large bundles sweep over the margin of the socket and are continuous with those of the muco-periosteum of the alveolar processes. In chronic inflammatory conditions, the attachment of the gum to the neck of the tooth may be so dense as to render the complete removal of the root difficult, even after it has been loosened from its socket.

It is usually the root or roots that a dental surgeon wishes to remove in extracting a tooth, though one would not infer it from a study of the instrument catalogues, or from the collection of forceps owned by most dentists. So far as the incisors, canines, and premolars go, the forceps are almost universally adapted for grasping the root, and are so far constructed on proper lines. It is otherwise in the case of the molars; for molar forceps are designed to grasp the neck of the tooth and not the roots. Hence to extract successfully with them, the

attachment of the roots to the crown must be sufficiently strong to prevent a fracture when force is applied to the crown or neck of the tooth. Now what does one find in practice? The dentist examines the offending molar, and guesses (for it can be nothing more) that the roots are united strongly enough to each other and to the crown to indicate the use of "molar" forceps. In a very large proportion of cases his guess is wrong, and in the attempt at extraction, the crown comes off with or without separation of the roots. What does he do then? He lays aside the "molar" forceps and takes up "root" or "stump" forceps, which are designedly applied, not to the crown or neck, but to the part of the tooth he really wishes to remove, namely, the roots. Now the time consumed in this changing of forceps, if the patient has had nothing to relieve the pain, or if he has only been under the fleeting influence of nitrous oxide, is very serious. It is a matter for astonishment that such forceps should still be in common use, when they are condemned alike by reason and by the accumulated experience of years.

Examination of a pair of upper molar forceps shows that one blade is concave on its inner surface to embrace the neck of the tooth at the junction of the lingual root and crown, whilst the other blade usually ends in a central point longer or shorter in various forceps, from which concave surfaces and edges usually diverge. In application, the point is supposed to pass between the two facial roots and the lateral portions of the blade are intended to grasp the neck of the tooth, where the mesial and distal roots join the crown. When the extraction is attempted, the facial blade acts as a wedge between the two roots, and if the attachment of the roots to one another or to the crown is weaker than the attachment of the roots to the socket, the crown is fractured off at the neck or the roots are separated, and probably none of them are removed from the mouth. Again, owing to the width and shape of the blades, no amount of force that can be applied by the average arm can drive them far enough up the roots to obtain a deep hold—in fact the forceps are made to grip *the neck* of the tooth. Another serious objection to "upper" molar forceps is that a pair is required for each side of the mouth, the change from one pair to the other consuming valuable time in a nitrous oxide narcosis.

Still another objection is that the facial blade, as a matter of fact, will not grip the neck of quite a large number of teeth, especially second molars. There are two reasons for this. One is that the two facial roots may be so completely fused as not to present even a groove wherein to lodge the point of the blade (fig. 16, F). I have frequently noticed that after ineffectual attempts to extract such a tooth with orthodox forceps, the

operator has been successful with root forceps. The other reason is the oblique-rootedness of some teeth. In marked cases this can be diagnosed from the shape of the crown, if it be present; but there are many cases of this condition which even an expert may miss. In this form of tooth the neck is flattened mesio-distally, the distal roots lying much more to the lingual side than normally (fig. 16, E.). Now the more firmly the operator attempts to grasp such a tooth, the more the facial blade slips distally, owing to its mesial half being an inclined plane and its point not engaging between the roots. It is impossible to extract the tooth in such circumstances, and all that results is waste of time and unnecessary damage to the surrounding tissues, with



FIG. 13

Shows orthodox molar forceps applied to an oblique-rooted molar, and the inefficient grip obtained.



FIG. 14

Shows the same tooth as in fig. 13 firmly grasped by root forceps.

possibly severe pain to the patient and even dislodgment of the third molar (figs. 13, 14).

All these considerations apply equally to lower molar forceps, but possibly more so, as both blades end as pointed wedges, the result being that if the tooth is not removed entire by them, almost invariably both roots are left, and then root forceps have to be used.

Now all this being so, is it not more rational to ignore the crown and use at once forceps adapted to extract the roots?

It is consequently of very great importance that the operator should have an accurate knowledge of all the roots and of their common variations; and moreover, as will be seen later on, his knowledge should be so intimate that he can, by a rapid glance at a root, determine which one it is—this applies especially to the roots of molars.

Generally speaking, the roots of human teeth are straight and conical, but many and great variations are found. Normally,

they are thickest and strongest at the neck where they join the crown, but sometimes, as a result of productive pericementitis, there is considerable thickening distal to this.

The **maxillary central incisor** (fig. 15) has one root and from the standpoint of the extractor may be described as strictly conical. Any curvature even at the apex is an extremely rare condition.

The **maxillary lateral incisor** (fig. 15) has one root, and the whole tooth being in many respects a smaller edition of the central incisor, its root is like that of its neighbour. It is, however, more slender and tends to be slightly flattened mesio-distally, whilst a gentle curvature in the apical third, the concavity of which is almost invariably distal, is quite common. An exaggerated example is seen in fig. 15.

The root of the **maxillary canine** (fig. 15) is also single, but in other respects it is variable. It is usually longer than the roots of the neighbouring teeth, but it varies considerably in different cases. Though strictly speaking somewhat triangular in transverse section, it may be considered conical; but in abnormal cases the facio-lingual diameter may be considerably longer than the mesio-distal. It may be slightly but sharply curved quite at the apex, the concavity being frequently distal or, especially in teeth erupting high up in the alveolus, facial. Usually it is very firmly implanted in its socket and may require considerable force to dislodge it.

The **first maxillary premolar** (fig. 15) has usually two conical roots arranged facially and lingually, but it may have only one, which is then flattened mesio-distally and has a deep groove on its mesial aspect. Occasionally it has three roots, which are then arranged like those of the maxillary molars, two facially and one lingually. It is in the author's experience more liable than any other to fracture during attempts to extract it, the



FIG. 15
Typical maxillary teeth.

reason being that the roots are very slender and that they are surrounded facially and lingually by thick bone.

When a root is extracted, it is loosened by rupture of the pericementum and by the enlargement of the socket owing to the bony walls being fractured or bending outwards, as happens when the bone is young and thin. In the case of the roots of the first premolar, however, and of the distal root of the maxillary molars, the roots are so slender that they are very apt to fracture before the stress applied through the forceps is sufficient to loosen them in their sockets. Such a fracture is entirely unavoidable. If one root comes away, it is usually the lingual one, so if there is any doubt and time is urgent, as in a nitrous oxide case, one should hunt for the facial root.

The **second maxillary premolar** (fig. 15) has almost always one root, which is flattened mesio-distally and usually deeply grooved on the mesial surface. It may, however, have two conical roots, facial and lingual, the point of bifurcation being anywhere between the neck and apex. In rare cases it may have three definite roots arranged like those of the maxillary molars.

It is particularly in the case of the roots of the molars that a knowledge of their form is so valuable for the sake of both operator and patient. A clinical picture will make this clearer. Supposing a dentist wishes to remove a broken-down maxillary molar, the patient being under the influence of nitrous oxide. He perhaps decides to use upper molar forceps, but only succeeds in further breaking down the tooth and making the gums bleed, thus obstructing his view. He now discards the molar forceps for root forceps. With these he removes a root. Which one is it? With another application of the forceps, he removes another root. Which one is it? The patient is by this time rapidly recovering consciousness, and the operator, because of this, excitedly digs about in the socket for the missing root, probably wasting valuable seconds hunting in vacant sockets! An experienced operator would, whilst withdrawing the root from the mouth, recognise which one it was, and definitely remove it from his forceps by sharply wiping the blades on the rough towel tucked round the patient's neck, thus enabling him to examine it again, if necessary. Even when the roots are considerably altered by disease, it should almost always be possible to recognise them, and so no valuable seconds are lost in hunting in impossible places for them. The same principle applies to the roots of mandibular molars, and consequently time is well spent in considering the roots of molars from the point of view of the extractor.

Maxillary molars (fig. 16) usually have three roots; and they are generally typical in the first molar, less so in the second, and

still less so in the third. There are two facial roots and one lingual, which are almost invariably separate. Both facial roots are flattened mesio-distally and are triangular in shape and more or less parallel to each other. The facial edge forms a

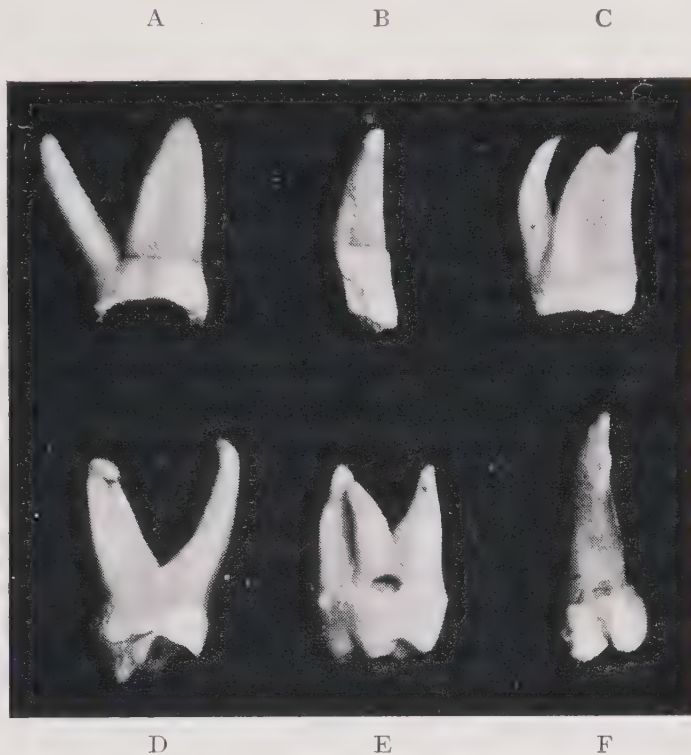


FIG. 16
Maxillary molars.

(A) Typical first molar, mesial and lingual roots. Note divergence of lingual root, and as in (D) the precarious hold for forceps if the lingual part of the crown and neck were broken off, and if the usual instructions to "pull downwards and outwards" were followed.

(B) Mesial aspect of distal root of same tooth, which has been sawn off and displaced to allow of comparison with mesial root. Note that though about the same length as the mesial one, it is much narrower at the neck facio-lingually, and it is consequently more slender. For the same reason the mesial and distal surfaces are seldom grooved, whilst those of the mesial root often are. The facial borders of both roots are broad and rounded, but the lingual ones are thin and sharp, so that a transverse section is wedge-shaped. Compare with the lingual root, which is circular or oval in section, having no sharp edges.

(C) Second molar with curved lingual root and notched mesial one.

(D) First molar, distal aspect showing the narrow lingual root in situ, and a curved lingual one.

(E) Oblique-rooted second molar, the distal root occupying a position abnormally lingual.

(F) Second molar with one broad facial root showing only the faintest trace of a groove to indicate the mesial and distal roots. The lingual root is quite distinct.

right angle with the neck of the tooth, and the lingual edge slopes facially from the neck to the apex. The *mesial root* is distinctly larger than the distal; not because it is appreciably longer, but because its junction with the crown at the neck is

much broader. The apex of the root sometimes presents a slight bifurcation which makes its identity almost certain. The *distal root* has a much narrower junction to the crown than the mesial, and being about the same length as its fellow, is consequently more slender—this fact is of great practical importance, as will be seen later on. It is placed more lingually also, and in very pronounced cases of “oblique-rooted” teeth may be almost between the mesio-facial and the lingual roots.

The *lingual root* is the largest and longest and diverges from the facial ones to a varying degree. It has no sharp edges and is frequently grooved along its lingual aspect. Towards the crown it is elliptical in transverse section, tending to become more circular towards the apex.

In the **second molar**, the roots have much the same characteristics as in the first, but variations are more common. Thus the tooth may be much narrower mesio-distally at the neck, causing the facial roots to lie very closely together and to be more parallel, whilst they are not infrequently curved distally. The lingual root also tends not to diverge so much as in the first molar, and its apical third is more frequently slightly curved, with the concavity directed facially. It is not uncommon for two or more roots to be developmentally united more or less completely, and it is useful to remember the relative frequency. Most commonly it is disto-facial to lingual, then mesio-facial to lingual, then all three together, and lastly the two facial roots. The facial roots may be so imperfectly separated and so narrow mesio-distally as to present the appearance of a rather large mesial root. The mistake, however, is not likely to occur if this peculiarity of the second molar is kept in mind, and the root very carefully examined facially for a fine groove which is nearly always present. This tooth is “oblique-rooted” more frequently than the others.

The **third molar** may have one root, which is shorter than those of the other molars and often curved distally towards the apex. It is usually grooved, indicating the tendency to the formation of three roots. Not infrequently, however, it has two or three roots, which as a rule are only completely separated near their apices.

Maxillary molars may have an **excess of roots**, more than one, however, being very rare and then usually on the third molar. The extra root is almost invariably mesio-lingual, resulting in the tooth having two facial and two lingual roots. The presence of this fourth root distinctly modifies the shape of the mesio-facial one, which is much narrower facio-lingually and consequently very slender. A fourth definite root is most common in connection with the first molar, and in most of my specimens the roots are all very long, very slender, and very divergent.

The **mandibular incisors** (fig. 17) have one root, which is flattened mesio-distally, that of the lateral incisor being longer and larger than that of the central.

The **mandibular canine** (fig. 17) also has one root flattened mesio-distally, and, as in the case of the maxillary one, it may be described as roughly triangular in section, the facio-lingual diameter, however, being much greater than the mesio-distal. Its socket is usually large and extends deeply into the body of the bone, so that the tooth may require considerable effort to remove it. More often than is usually supposed, this tooth has two roots, there being at times an accessory lingual one, which varies considerably in its point of origin; but is usually shorter and smaller than its fellow, from which it diverges but slightly.

The **mandibular premolars** (fig. 17) have one root each. They are usually considerably smaller in transverse section than the crowns which surmount them. They are straight; but the apex, especially of the second, may be turned distally. The apical half is implanted in thick dense bone; and consequently the root is rather apt to fracture at this point in spite of every care. The root of either tooth may be deeply grooved disto-lingually, but an extra root, even to the extent of the root ending in two processes an eighth of an inch long, is very rare.

The **mandibular molars** (fig. 18) have two roots, a mesial and a distal, which are almost always quite separate in the first molar. As in the case of the maxillary molars, the roots are most typical in the first molar, less so in the second, and least in the third. They are flattened mesio-distally, especially the mesial ones. The *mesial root* is distinctly broader facio-lingually than the distal one, being about as broad as the mesial part of the crown. Both the lingual and the facial margins are rounded, the latter, however, being broader. The two margins keep fairly parallel



FIG. 17

Typical mandibular teeth.

till near the apex, to which they somewhat suddenly converge. The root is broadly grooved on its mesial surface and is also grooved distally. It is usually straight, but may be curved distally. Like the mesial root of the upper molar it may be notched at the apex, this making its identification certain. The *distal root* may be very similar to the mesial, differing only in being somewhat smaller. In the vast majority of cases, however, it



FIG. 18

Mandibular molars.

Note.—(1) Mesial root grooved mesially and distally, edges more or less parallel, and their sudden convergence to the apex.

(2) Distal root with deep narrow groove mesially but convex surface distally. Root narrower than mesial one, and edges converge from neck to apex.

(3) These characters in the tooth with notched root and in the tooth with an extra root.

differs in one or more points sufficiently to make its identification easy and certain. It is distinctly narrower facio-lingually than the mesial one, as it does not extend so far lingually; and being at the same time as thick or thicker than the mesial one mesio-distally, it has more rounded margins facially and lingually and is more elliptical in cross section, the mesial one being somewhat "figure-of-eight" in shape. Its facial and lingual margins, unlike those of the mesial root, converge from the neck evenly to

the apex. The distal surface is almost always convex facio-lingually, whilst mesially it is almost invariably somewhat deeply grooved, so that in cross section, especially near the neck, it is kidney-shaped rather than elliptical. The root may be curved, usually mesially, but sometimes distally.

In the **second molar** the roots are usually typical ; but they tend to be closer together, and may both be curved distally. There may be but one large, tapering, somewhat four-sided root, with practically no groove lingually or facially to indicate the tendency

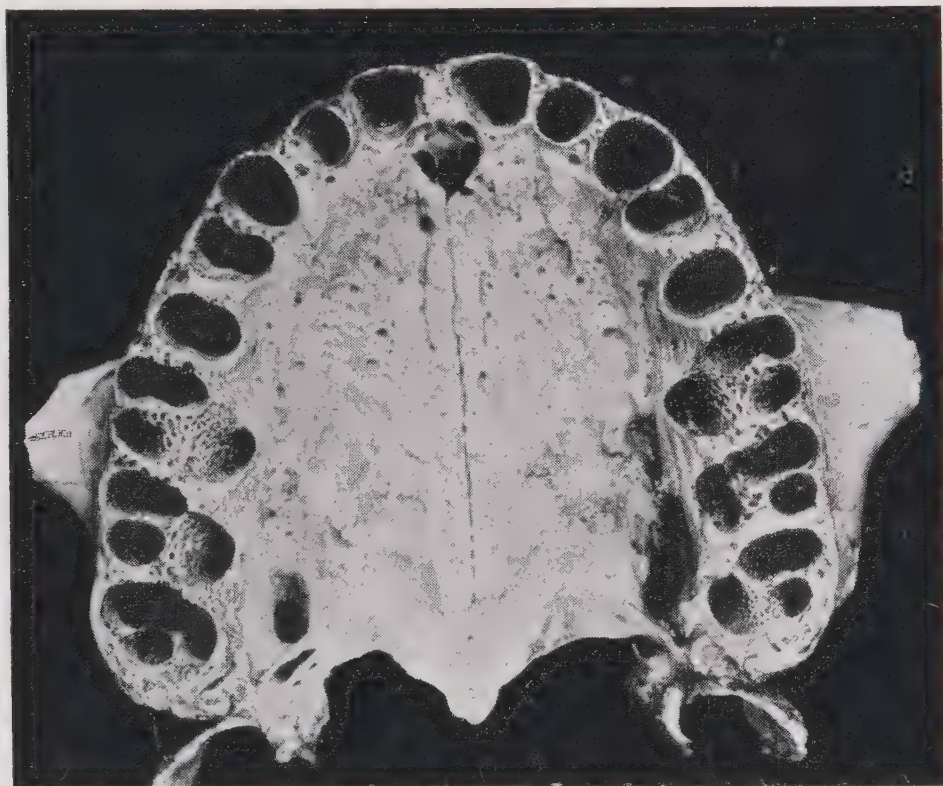


FIG. 19

Sockets of maxillary teeth. Bell collection in Museum of Royal College of Surgeons, Edinburgh: The shape of the sockets also serves to show the shape the roots of the teeth would have in transverse section at the necks.

to two roots. The great majority of these single-rooted molars, however, are deeply grooved lingually, so that the tooth in transverse section is horseshoe shaped.

The **third molar** has one or two roots, which vary considerably in size and shape in different specimens ; but the majority conform to the normal and, whether multiple or single, are frequently curved distally.

An extra root is much more frequent in the mandibular molars than in the maxillary. It is almost always situated disto-lingually and varies considerably in size. The third molar more often than the others has four roots, and teeth with five and

six roots have been recorded. That the possibility of extra roots should always be borne in mind, especially in connection with the molars, is proved by the following case about which the author was consulted recently. A lady had an abscess in connection with a second mandibular molar. The dentist in extracting it broke off the crown and then removed two roots which he showed to the patient. The symptoms did not subside, and upon the patient's applying for relief and suggesting that part of the tooth was still in, the dentist insisted that it *must* be all out, as he had shown her the two roots. The case dragged

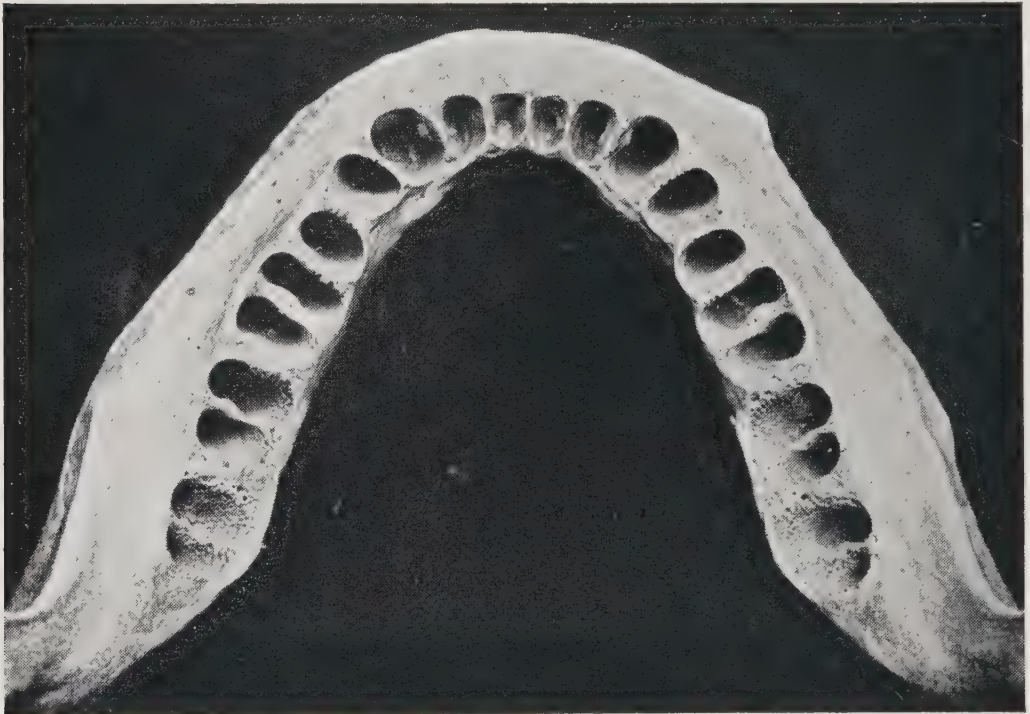


FIG. 20

Sockets of mandibular teeth. Museum of Royal College of Surgeons, Edinburgh. The shape of the sockets also serves to show the shape the roots of the teeth would have in transverse section at the necks.

on for a week, when the patient went to another dentist who extracted the third root with the result that the first dentist has lost an indignant patient.

The alveoli (figs. 19, 20) conform closely in size and shape to the roots which they contain, as only the thin pericementum intervenes between them and the roots. Consequently the photographs of them serve to indicate not only the appearance of the sockets and the thickness of the surrounding bone, but also the shape of transverse sections of the roots. One can see which sockets are sufficiently circular to allow of the roots they contain being rotated.

The bone surrounding the sockets is cancellated, except for

a thin superficial layer of compact bone. In the maxilla the facial plate is thinner than the lingual, and this is true on the whole of the mandible. Towards the front of the mandible, however, the difference is not so marked; whilst in the region of the second and especially of the third molar, the lingual plate is thinner and the facial plate attains considerable thickness. The bone is usually thinnest at the free margin of the socket, where it normally ends as a sharp edge. Occasionally, however, the socket is incomplete, the facial wall being uncalcified in whole



FIG. 21

Mandible showing some incompletely ossified alveoli, and two impacted third molars, the left lying horizontally and the right obliquely.

or part. This refers especially to teeth with prominent roots, such as the mandibular incisors and canines, in which the socket is frequently incomplete towards the neck of the tooth (fig. 21). The apical region of the socket may also be incomplete (fig. 22), especially in the premolar and molar region of the maxilla, where the roots on their facial aspect may be covered merely by mucoperiosteum, no bone intervening. In these cases, however, there may be an abnormal thickness of bone around the necks of the teeth—a matter of some surgical importance, as it may lead to extensive fracture of the alveolus, with damage to neighbouring teeth in spite of the utmost skill and care. This may be an altogether unavoidable accident, and yet many a time has

it been a cause of great anxiety to the dentist, owing to threatened or actual actions for damages for malpractice, actions which at times have been successful.

The apices of the maxillary molar roots may be in intimate relationship to the floor of the maxillary sinus (fig. 23). If a horizontal section is made through the middle of a number of maxillary sinuses to enable the floor to be examined, the majority will show no evidence of the sockets which lie beneath. Occasionally, however, one or more little conical, bony projections occur, covering the apices of roots, which are projecting beyond the



FIG. 22

Skull showing incomplete alveoli over the apical portions of some of the roots.

general level of the floor. Again, if the mucous membrane of the sinus be stripped off, the projecting socket will be found complete in some cases, whilst in others the apex of the root will be found projecting a variable distance beyond the bony socket, so that it is separated from the cavity of the sinus simply by its muco-periosteum. These anatomical relationships are of importance from several standpoints, the one with which we are concerned at present being the ease with which such a root might be forced into the cavity of the sinus during an attempt to extract it.

In the mandible the apices of the premolars and of the molars, especially the third molars, may be in intimate relationship to the mandibular canal, and cases have been recorded of damage to

its contents in extracting these teeth. In one case the nerve and vessels actually passed through a foramen formed by the reunion of the roots of a third molar at their apices (Sewell), whilst the author has published a case of injury to the nerve, which was probably lying in a groove that was found on the side of the tooth after extraction.

It should be remembered that the alveolus around isolated



FIG. 23

Floor of right maxillary sinus, showing elevations corresponding to the apices of the molar roots. At best the bone is as thin as tissue paper, and over many of the roots it is actually absent.

teeth tends to become sclerosed—probably a compensatory process, and it may be so rigid as greatly to increase the risk of the tooth being fractured in the attempt to remove it. This is more noticeable in the mandible than in the maxilla, and it is frequently observed in the isolated second molar when the first and third molars have been extracted some years previously; also in the second premolar, when its neighbours have been lost for a long time.

CHAPTER IV

CIRCUMSTANCES OF THE OPERATION

WHEN a large number of teeth or roots are to be extracted under a general anæsthetic, the operation assumes some magnitude and the evil results can be greatly mitigated by attention to details.

One of the first questions to be settled is the **choice of the anæsthetic**. In most parts of the world the matter has been settled so far as chloroform is concerned, but unfortunately this is not the case in Scotland, where in spite of the inroad that other anæsthetics have made, chloroform is still largely the one and only anæsthetic, no matter what the operation or the physical state of the patient. It is proverbial that "doctors differ," and the fact that the personal equation necessarily looms so largely in the practice of medicine, makes it all the more significant and interesting that there is one question on which there is absolute unanimity amongst all specialists in anæsthesia, viz., that **chloroform should never be used as an anæsthetic for dental operations**. The attitude that the dental surgeon takes to the question of the choice of an anæsthetic is somewhat astonishing; for, in general, he seems to repudiate any responsibility in the event of an unfortunate accident happening, laying it entirely on the medical man, whom he allows both to choose and to administer the anæsthetic, without protest from him or even the expression of an opinion. Such an attitude is not only undignified and cowardly, but wrong to the patient, to the medical man, and to himself. The dental surgeon is a specialist and should know, and on the whole does know, the relative values and relative dangers of the common anæsthetics, so far as they concern his special department, very much more accurately than the average medical practitioner. What would be thought of any other specialist who felt so little responsibility towards his patient as to consent to operate under conditions which he knew needlessly exposed him to very grave risks? Moreover, the great bulk of patients who require more than nitrous oxide for a dental operation are in the best of health and on the threshold of life. Considering that there are general anæsthetics eminently suitable for dental operations, and practically free from all risk, it is surely bordering on malpractice wilfully to choose the most dangerous

one for what is after all in itself a trifling operation. If the dentist is conversant enough with his speciality to know what everyone is agreed upon who has specially studied the subject, viz., that chloroform has no place as a dental anæsthetic, then if the patient's medical man proposes to use it for a dental operation, it is his bounden duty to himself as a professional man and to his patient, to suggest a suitable anæsthetic, and if need be absolutely refuse to operate with the patient under chloroform. When one comes to consider it, what other attitude is there for anybody with any self-respect? After all the general practitioner is a reasonable man, but having to retain a working knowledge of the diseases and treatment of the whole body, he cannot be expected to be a specialist in a part of surgery that has been practically relegated to a special profession. Hence it falls to the dentist as to other specialists to point out to the general practitioner, if necessary, the special needs and modifications required in his own work, and it is equally the duty of the medical man to listen with all consideration to the views expressed, and for both to remember that the well-being of the patient must override all personal considerations of dentist and doctor. Where difference of opinion arises, and arise it will for many years, where Scottish medical graduates are to be found, the exercise of tact and courtesy on both sides and of firmness on the part of the dentist in doing what he knows to be right, will not only end in the doctor's giving way to the logic of his special knowledge, but raise him in the estimation of his colleague. The dentist would be wise to emphasise his own difficulties and dangers in operating with the patient under chloroform.

It is astonishing when one discusses the subject with many medical men, how they will begin to argue that whilst they have had anxious cases, they have never had a death even although they have administered chloroform hundreds of times. It seems that the line of thought is to go on administering the drug until one has a death, and not till then to reconsider one's position. The fact that others have administered it thousands of times and then had an accident does not appeal to them; nor does the fact that with other anæsthetics deaths during tooth extraction are as rare as with chloroform they are common. It is then not only right but necessary that the dentist should have valid reasons for the faith that is in him; and therefore the question is discussed here.

In the first place, the primary reason for using chloroform is to obtain a long anæsthesia; but a long anæsthesia is not necessary, even for the extraction of all the teeth in the mouth. As a matter of fact, the extraction of each tooth or root completes an

operation, and so the mouth can be cleared in several short operations, even with nitrous oxide. Admitting that there are great drawbacks to this alternative method, then there is another anæsthetic, ether, with which even a longer available narcosis than that possible with chloroform can be obtained and with almost perfect safety. Hence the reason usually governing the choice of chloroform falls to the ground.

Chloroform is the most dangerous of all the anæsthetics in common use, and its inherent dangers are enormously increased in certain operations. To such an extent is this true in the extraction of teeth that no one, who is conversant with the subject and with the large number of unrecorded fatalities attendant on the operation, will question for a moment the statement, startling though it may appear, that the operation of extracting teeth, when the patient is under the influence of chloroform, is one of the most dangerous operations in the whole realm of surgery.

Why is it that chloroform is so lethal in this operation? This anæsthetic is almost invariably administered with the patient in the supine position. In order to let the dentist operate freely, the patient must be fairly deeply narcotised, sufficiently at least to overcome masseteric spasm, and in many cases this requires a deeper anæsthesia than is necessary for most other operations. At the same time the lingual muscles are paralysed, and the tongue tends to fall backwards from gravity. The tendency to occlusion of the air-passages thus produced is increased when the gag is inserted and the mouth opened—especially if widely opened, as is often necessary. Then the dentist commences to operate, and the danger lies particularly in the extraction of the mandibular molars. So fully is this recognised that many dentists deliberately leave them alone, especially if they are difficult roots, preferring to extract them later on with some other anæsthetic and with the patient sitting in the dental chair. The reason of this special danger is that it is IMPOSSIBLE for any operator, however skilful, to extract these teeth without very materially interfering with the patient's respiration, by pushing the tongue forcibly inwards and backwards. In addition there is the added obstruction of saliva, blood, and blood-clot, all of which are gravitating directly into the pharynx. Sponges are called into requisition, and this further hampers respiration. The deglutition reflex is probably in abeyance, and saliva and blood are trickling into the larynx and even trachea and bronchi, adding still further to the danger of the patient. It is a well-known fact that an amount of respiratory obstruction that falls far short of completeness may, in the case of chloroform narcosis,

be one of imminent danger ; and it cannot be too strongly urged how often it happens that whilst those in charge are satisfied *because* the patient is breathing more or less regularly, the unfortunate victim is being rushed rapidly on to destruction.

Why is this partial, and in the circumstances, unavoidable respiratory obstruction so fraught with danger ? The available anæsthesia depends upon there being a sufficient quantity of the drug circulating in the blood and reaching and paralysing certain nerve centres. The sensory centres are paralysed early, whilst the motor centres vary considerably in the amount of anæsthetic necessary to paralyse them. For due performance of an operation certain motor centres must be paralysed, varying to a certain extent with the operation. Thus certain reflexes may be quite active in one operation without inconvenience that in another operation would make its performance impossible. Now all inconvenient reflexes must be abolished without interfering with the vital motor centres in the medulla oblongata—respiratory and cardio-vascular. An anæsthetic is safe in proportion to the resistance of the vital centres to its action and to the susceptibility of the non-vital motor centres to the same action. It is well known that some narcotics depress the vital centres even before the sensory centres are in abeyance and in consequence are impossible as anæsthetic agents. At the other extreme there is nitrous oxide with which the non-vital motor centres can be paralysed, whilst the medullary ones are so resistant to its action that before it is possible to administer a sufficient dose to paralyse them, the patient dies from asphyxia brought about by spasm of the muscles of the respiratory pump. In the case of chloroform the dose that is necessary to paralyse inconvenient reflexes is very little smaller than that which will paralyse the vital centres in the medulla. Consequently, if the patient be anywhere nearly fully narcotised, any procedure that suddenly leads to the absorption of a further dose, even a small one, may kill him. Now the anæsthetic is not only absorbed into the blood stream from the lungs, but it is also excreted by the same channel, and once the patient is narcotised, it is the duty of the administrator so to arrange the dose that the balance between absorption and excretion shall maintain the proper amount circulating in the blood and through the nerve centres.

What then happens when the dentist in his operative procedure interferes more or less, usually more, with the respiratory functions of the patient ? At the time that the administrator says that the patient is “ready,” there is presumably nearly a maximum safe dose circulating in the patient’s blood ; but there is also a large quantity of chloroform in the alveoli of the lungs, which is diluted down and rapidly removed at each respiratory movement,

and as the percentage lessens in the alveoli, more and more chloroform passes from the blood into the alveoli and so is excreted, and the patient begins to "come out." If, however, the dentist causes respiratory obstruction, even if partial, the reverse process occurs, and the blood rapidly absorbs a further dose from the relatively high percentage in the alveoli and now may carry a dose sufficiently large to paralyse the medullary centres, and so another is added to the long list of absolutely unnecessary and therefore inexcusable deaths. At the same time, the anoxæmic condition greatly increases the vulnerability of the vital centres to the action of the narcotic agent—an added danger that with most anæsthetics is of no moment, but one that with chloroform increases the risks enormously.

The fatal result, however, may and probably usually does come about in a somewhat different way. Chloroform is a direct cardio-vascular depressant, and it has been shown to affect specifically the myocardium, tending to paralysis of the muscle and consequent dilatation of the cavities. It has on the whole a similar effect on the blood vessels. In addition, large doses inhibit the vasomotor centre, tending to a still further lowering of the blood pressure. What happens then when the dentist, through no fault of his own, interferes by his manipulations with free respiration? The chloroform in the pulmonary alveoli is rapidly taken up by the blood and circulates to the heart muscle, rapidly completing the paralysis which is always tending to occur in chloroform narcosis; and the heart, although it may go on feebly contracting, ceases to be able to expel the blood, and the circulation comes to a standstill. It will be remembered that the coronary arteries which supply the heart muscle come off from the very commencement of the aorta, so that the overdose which has been collected by the pulmonary veins is poured immediately and undiluted into them. It is true that "respiration generally ceases before cardiac action actually fails"; but the fatal result is not due to failure of respiration primarily—for then the patient could be saved by immediately resorting to artificial respiration—but to the impossibility of re-establishing the circulation of the blood, and of getting the poisoned heart to resume its function. Of course there are other factors which may contribute to the fatal ending, but they do not depend upon this operation *per se*. The reason for entering at all into the question of chloroform fatalities is because, without doubt, the appallingly large proportion of deaths under chloroform for the comparatively trivial operation of tooth extraction is the outcome of the nature of the operation, and had the same anæsthetic been administered to the same patient under the same circumstances for an operation that did not interfere with respiration

in any way, there would probably have been no untoward result. One must emphasise the fact that even an expert may in a difficult extraction unavoidably interfere with respiration for a length of time that is highly dangerous to a patient under chloroform. How much more so then will the average, or only indifferently-good operator do so ?

The supine position of the patient is about the worst possible for the operator, especially in the extraction of mandibular molar roots. So true is this that, as has been said before, many good operators make no attempt to extract them under chloroform narcosis ; but do so subsequently with the patient under an anæsthetic that admits of the sitting posture. What with the difficulties of the operation owing to the posture, to the frequent sponging out of the throat, to the readministration of the anæsthetic and so on, the operation seldom takes less than half-an-hour and frequently twice as long, and during the whole period the patient usually young and in the best of health is in imminent peril, all for a trifling operation !

There is great risk of foreign bodies passing into the lower air-passages. This happens with blood and saliva when the deglutition reflex is in abeyance, and unless careful watch is kept, slow and insidious respiratory obstruction may set in with sudden death from cardiac poisoning. Also with the greatest care and skill it is impossible for the dentist always to retain a tooth or root in the blades of the forceps. They frequently from their conical shape slip out of the socket, and may fly out with such violence as to break a window or destroy the dentist's eye or cut his cheek—they may just as readily, in fact more readily, slip or fly into the pharynx. Again, it is very common for weak fragments of the crown to be broken off by the forceps and for fillings to be dislodged in the same way. Owing to the influence of gravity and to the slipperiness induced by mucus and blood, these heavy bodies rapidly pass towards the pharynx. Most of them are caught by the operator, many are swallowed by the patient ; but some unfortunately, especially when the patient is fully anæsthetised and the deglutition reflex is absent, pass into the larynx, trachea or a bronchus. The supine position also leads to another risk, if there are *light* foreign bodies loose in the mouth such as a fragment of enamel, gutta-percha filling, tartar or a piece of torn sponge. The average dentist, for some unaccountable reason, seems to see no element of danger in such bodies, but the danger is very real ; for owing to their smallness and lightness, they are easily carried by a sudden inspiration from the dorsum linguæ into the lower air-passages.

Another objection is the time consumed; and in hospital practice time is a very real consideration. It has already been stated that under chloroform narcosis the operation of clearing the whole mouth will take anything from half to one hour. With ether as an alternative anæsthetic and the patient in the sitting posture, the average operator should be able to clear the mouth within ten minutes—the whole operation, including induction of anæsthesia and recovery therefrom, taking about ten minutes.

The after-effects are generally more severe. This is due to several causes. Firstly, chloroform sickness is usually of a distressing nature and is apt to last much longer. As a patient who had had experience of both chloroform and ether on several occasions once said to me: "One may be more sick with ether, but with chloroform one *knows* that one is sick, and can never forget it."

A very large experience has convinced me that the after-sickness is greatly aggravated by the swallowing of blood, and that, even after the blood has been vomited and the stomach washed out, the sickness and nausea often persist. Now, with the patient in the supine position, all the blood, saliva, and pus tend to be swallowed, when the deglutition reflex returns, and in practice one finds that, in spite of the most thorough sponging, large quantities are invariably swallowed.

With these considerations in view, the medical man and the dentist must seriously ask themselves, whether considering the number of actual deaths that have occurred, to say nothing of the number of patients that have been snatched from death, it is right to subject the patient to any risk at all, when there is at least one other anæsthetic available which with even ordinary care can be described as practically safe, will produce if required a much longer available anæsthesia than chloroform, permits of the patient being in the sitting posture, reduces the duration of the operation to a minimum, leaves the minimum of after-effects and practically relieves the watchful administrator of any anxiety.

Thus there is left only one general anæsthetic for the average operator, when a large number of teeth are to be extracted, and that is ether, which is usually used in sequence to, or in mixture with, nitrous oxide or ethyl chloride. It is true that an expert might manage the same case equally well with ethyl chloride, whilst many would advocate "continuous gas." There is much to be said on both sides, and though one finds exceptions to the statement, it is nevertheless true that ether is pre-eminent as an anæsthetic in cases of extensive extractions.

Another question to be considered is **where the operation is to be performed**, at the dentist's or at the patient's own home, and about this there is considerable difference of opinion.

It is true that the actual operation is more conveniently performed at the dentist's, where he has a suitable chair and everything that he needs. On the other hand, when the operation is finished, he has the patient occupying a room and requiring attention for a varying length of time, and then the patient has to be sent home, possibly some distance. In addition, there is a smell of ether pervading the house for a considerable time, and this is very unpleasant for subsequent patients. Even from the dentist's standpoint, the balance of convenience is distinctly in favour of the operation being done at the patient's house, whilst from the patient's standpoint there is no doubt about it. Although the extraction of teeth is usually taken lightly, it is equally true that there is no operation more dreaded by the average patient, when the time comes. People dread going to the dentist's at all times, and the mental condition of the patient is distinctly happier, when the operation is done at home in familiar surroundings.

Then too, after the operation is finished, the less the patient is moved about the better. It should therefore be done in the room in which he is to lie for the rest of the day, preferably in the bedroom, so that he can be put at once to bed. It is not doing one's best for a patient, especially in winter, to send him home, perhaps a long distance, after an operation which is frequently of a more severe nature than many for which other surgeons send their patients to a nursing home for at least a few days. It will be to the advantage of everyone concerned, when these extensive extractions are considered surgical operations, and treated, whenever possible, in accordance with the general principles governing such operations.

Again, the dentist is saved a considerable amount of time and trouble by operating at the patient's house, for having made the patient comfortable and given all necessary directions, the sooner he leaves the better. In addition, it breaks the monotony of always working in one room, and gives the dentist an opportunity of getting some fresh air that day which he might not otherwise get, and also of meeting some of his patients in their own homes, a point that has more than one advantage.

Lastly, if the dentist is going to consent to the administration of chloroform, he should never be induced by any consideration to allow it to be administered in his own house. The dangers even at best are so great that one can never be certain that the patient will leave the house alive, and should a fatality unfortunately occur, the sad event may damage the dentist for years to

come, not because the public will blame him personally, but because the tragedy becomes associated in the mind of the public with himself and his house.

It is also necessary to arrange **the day and hour of the operation**, and the patient having made up his mind to have it done, the sooner it takes place the better. With most patients the time between the decision and the operation is one of dread, often of sleeplessness, whilst one may be certain that every friend met with in the interval will detail some harrowing story of other people's experiences. There is a distinct advantage, however, in allowing time for a certain amount of preparation, and for that reason it is advisable to allow a clear day to intervene before the operation. As to the hour of the operation much is to be said as in the case of general surgical work for the early morning, say 9 A.M.; but the reasons are not nearly so cogent, whilst economic and social factors may have to be given some weight. Consequently, the hour may be arranged to suit all parties, but consideration can usually be paid to the time of meals. For instance, if the operation is to be at 9 A.M., the patient should be told to have no breakfast, though a cup of tea will do no harm. If a later time is chosen, about 12.30 or 1 P.M. is preferable to 11 A.M., as the patient can have a light breakfast at 8 A.M. or 8.30 A.M. Again, in the afternoon 5 or 5.30 is suitable, as the patient can then have a light lunch not later than 1 o'clock. These hours obviate interfering more than need be with the ordinary meals and yet afford the undoubted advantages to the patient of a fairly empty stomach.

The bowels should be well moved the day before the operation, and to this end the patient should be instructed to take a dose of castor oil or some form of mercury the night previously, and a dose of salts the next morning. Thus the average adult may take a "Blue Pill," or one or two grains of calomel. The latter may be had in tabloid or tablet form, or the powder may be flicked off a piece of paper on to the tongue and washed down with some water. There are many ways of administering castor oil. An easy way to take it is to suspend it between two layers of orange juice, taking care that the cup is warm. The saline draught next morning must be taken before food. It may consist of any of the natural aperient mineral waters, Apenta, Carlsbad, Friedrichshall, or it may take the form of Seidlitz powder or two to four drachms sodii phosphas or sodii sulphas or a like dose of magnesii sulphas (Epsom salts). The sodium salts are not at all unpleasant to take dissolved in half a tumbler of water; and the sulphate is more powerful than the phosphate. The magnesium salt, however, has a most unpleasant taste,

and various combinations have been devised to make it more palatable. It may be taken simply dissolved in half a tumbler of water and the mouth immediately rinsed out. Acid. sulph. dil., 10-15 minims, not only helps to cover the taste, but enhances the action of the salt, so that a somewhat smaller dose suffices. It is, however, usually dissolved in aq. menthæ piperitæ (2 oz.), or aqua cinnamomi (2 oz.), or given with spiritus chloroformi ($\frac{1}{2}$ drachm) in two or three ounces of water.

The patient should also be given instructions to **get the mouth into as clean a condition as possible** before the operation, as this undoubtedly favours the rapid and painless healing of the wounds and lessens the chances of complications supervening. A good plan is to brush the teeth after each meal with half-strength peroxide of hydrogen on the toothbrush. Again, the dental surgeon should thoroughly remove any calcareous deposits from such teeth as are going to be left in, for example, from the mandibular front teeth which are frequently coated with tartar; and it will also be a distinct help to remove it roughly from the teeth that are to be extracted. After the last meal before the operation, the patient should be particularly careful to cleanse the mouth.

Before setting out for the patient's house, the dentist must be careful to see that he has all the instruments he is likely to require, and he will be less likely to make mistakes if mentally he goes over the steps of the operation. For instance, he will probably want first to make a final examination of the mouth, and for this a mouth mirror may be required, and so a mouth mirror is set aside and so on. The instruments have already been sterilised, so far as pathogenic organisms are concerned, before being put away after the last operation. They are possibly contaminated with the common staphylococci; but as the patient's mouth is probably teeming with these, there is no need for special care in sterilising them again. They should be carried to the house wrapped in a large clean towel, or if they have been sterilised by boiling immediately before leaving, they can be carried in the steriliser.

Upon arrival there, certain preparations must be made. **A warm room with a good light** should be chosen and preferably one in which the patient can lie for the remainder of the day without being disturbed. A pie-dish should be obtained and into it a strong antiseptic solution poured and the instruments submerged in it, the whole being covered with a towel. The instruments can be used from the basin straight away, or, whilst the patient is being anæsthetised, the dentist can wring a towel out of the antiseptic and quietly place the instruments upon it. Then **a suitable chair** must be found. It should have a low seat, a high back, and wide-spread legs to give stability. A dining-

room arm-chair is usually available and quite suitable. A cane chair is often still more suitable, and if the back is short, the anæsthetist can easily support the patient's head on his arm during the administration of the anæsthetic ; and during the operation he can support the head in the palms of his two hands. A less convenient way is to bolster the patient up with pillows.

A large number of medical men who administer ether insist upon the patient's being recumbent as for chloroform. The author has administered ether (mainly for dental operations) with the patient in the sitting posture over 15,000 times, and only on two occasions was there cause for anxiety. In both cases, owing to the physical condition of the patient, he was prepared for trouble, and by intervening at the first indication, the operation was completed without any difficulty. It has been already stated that, with rare exceptions, patients about to have a number of teeth extracted are at the time in a fairly good state of health, and to such a patient the risk of administering ether in the sitting posture is, with ordinary precautions, practically nil. Of course there are the very rare cases that in a busy practice occur perhaps once in four or five years, in which it is safer for the patient to be recumbent ; but it is beyond question that for dental operations it is distinctly safer to administer ether in the sitting rather than in the recumbent posture, whilst the advantage to the dentist is inestimable.

The chair should be placed in front of the window and a number of newspapers spread in front and at the sides, to protect the floor from dirty teeth. A newspaper should also be kept in reserve. Those operators who trouble to keep the surroundings clean seem usually to ask for a sheet to spread on the floor. It may look more artistic, but it is no more efficacious, whilst the paper has the advantage that it simply needs to be burned at the end of the operation, a proceeding more sanitary and economical than washing sheets, soiled and infected with filthy teeth. The chair, however, especially if it is a valuable one, may well have a sheet thrown right over it, so as to protect it from the chance of a spot of blood. A large washhand basin half full of hot lysol solution is required, in which to wash out sponges, if necessary. It should be placed on the floor to the left of the chair, where it is out of the way of the operator. A small bowl is also required, into which the patient can spit. A shallow basin, such as the bottom of a soap-dish, is most convenient after the patient is put to bed or on a couch. Hot water and a tumbler should also be at hand.

The bed or couch should be prepared *before the operation*, as it is most important, in order to minimise unpleasant after-effects, that the patient should be placed in the lateral

prone posture as soon as possible after the last tooth is out. A bed is better than a couch, as the head requires to be kept low, hence if a couch is used, a chair will usually need to be placed at the foot of it, on which the patient's legs can lie. The bed-clothes should be turned back to the far side of the bed, and the pillows and bolster removed entirely. A low pillow is placed so as to leave at least a foot between it and the edge of the bed. This space, as well as the pillow, is covered with several sheets of newspaper, large enough for the patient's shoulders to rest upon them. Over the newspaper on the pillow is placed a soft thick towel folded once lengthwise, with one end hanging slightly over the edge of the bed. A hot-water bottle, if great care be taken not to burn the patient, and it must be remembered that patients recovering from an anæsthetic burn very easily, is not only a great comfort in winter, but is of distinct therapeutic value (fig. 25).

All preparations having been completed, the operation can now be proceeded with. The order in which the extractions are performed in a general clearance is different from that recommended when only a few scattered teeth are to be extracted and when sponges are not required. I start with the left lower side first, removing the tooth or root further back and working methodically forwards until the premolars are extracted. A sponge is rapidly pushed into the left cheek over the bleeding sockets, whilst the operator passes to the right side of the chair and changes his forceps for "upper" ones. If the sponge is in the way, it is withdrawn; but if not it remains, and the left maxillary teeth are similarly extracted, commencing with the one furthest back and working forward to the canine. A large sponge is inserted into the left cheek; and the right mandibular teeth, then the maxillary teeth, are similarly extracted. A sponge is then inserted in the right cheek. This order of procedure allows the prop to be retained between the front teeth to the last, and if these are to be extracted, it is now removed from the mouth, and the teeth, often only the maxillary ones, extracted. In this way it is quite easy to prevent any blood being swallowed by the patient and, especially if the injunction to work from behind forwards be followed, to keep a clear view of the field of operation.

The operation finished, the patient should be put into the bent-forward posture immediately, that is, the body should be bent well forwards from the hips, the head being held in line with the body so that it does not fall on to the chest and impede breathing and so delay recovery (fig. 24). The anæsthesia should be so adjusted that the patient is well on the road to recovery when the last tooth is extracted. The sponges having been

removed from the mouth, a small basin should be held with the rim pressed gently against the patient's skin under the chin, so as to catch any blood that runs out of the mouth, and the patient should be exhorted to spit. Immediately the operation is finished, the relatives or friends should be told that the patient is all right ; but they should if possible be kept out of the room, until he has been made presentable and the mess cleared away.



FIG. 24

Bent-forward posture into which patient is gently put, immediately the last tooth has been extracted. The position of the head allows of free respiration, and the basin is lightly pressed against the skin under the chin.

Whilst the anæsthetist holds the patient in this bent-forward position, the operator quickly washes his hands. The two then lift him out of the chair and quickly and gently lay him well on the bed or couch, in the latero-prone posture, so that he lies on the shoulder with the undermost arm close to the side, the elbow flexed, and the forearm lying comfortably on the bed. The head is arranged so that it rests on the edge of the pillow, with the mouth projecting slightly beyond it. The bottom of the soap-dish is placed under the patient's mouth

and the free end of the towel tucked in under his chin. He is covered up with blankets, and the hot-water bottle, if needed, put near his feet, but separated from them by a blanket. If he tends to roll over on his back, a pillow can be wedged in behind him as a support (fig. 25). He is told to lie quite still and simply to spit into the basin without raising the head. No water should be offered to him, unless he specially asks for it, and then he should just be allowed to give the mouth one good rinse out and be told the less he washes it out the better.

The first thing that a dentist usually does after extracting a tooth is to offer a tumbler of hot water to the patient and implore



FIG. 25

The patient lying on his side with his head resting on a towel at the edge of the pillow so that he can spit into the shallow basin placed under his mouth without being disturbed.

him to wash out the mouth. It is really amusing sometimes to see the intense satisfaction with which some practitioners watch a half-drunk patient almost choked, half drink, half spill the water, which they with the best of intentions assiduously pour into his mouth. There may be no harm in washing out the mouth after the extraction of one or two teeth, when the patient is quite sensible and not upset; but after extensive extractions not only is it needless and useless, but positively harmful. Everything in connection with the operation should be done to minimise discomfort and to aid rapid convalescence. As the patient recovers from the anæsthetic, there is a tendency to vomit, and this tendency is greatly increased by keeping him

in a sitting posture whilst he is ineffectively rinsing out the mouth and probably swallowing blood, which may have to come up again. One must remember that for a long time after he is conscious and can converse, he is very insensible to his surroundings, unless really roused, and consequently does not notice the unpleasant state of his mouth, and, if left alone, will spit out the blood and probably lie still. If offered water, he will try to sit up and even if that be prevented, he will shake his head vigorously, and in either case probably be sick as a result. Another objection is that the water interferes with the clotting of the blood by diluting it and by washing the forming clot away, and so favours the continuance of hæmorrhage. Also the clot formed being probably of poorer quality, there is more chance of reactionary hæmorrhage. Lastly, the formation of a good clot favours rapid and painless healing, and for this reason the common practice of syringing out the socket, and especially of bringing the patient back next day to do so is a mistake, as it washes away the very means that nature has provided to protect the socket and heal it up. There are rare occasions when frequent and thorough syringing are essential—these will be noted later on.

After the patient has been made as comfortable as possible and the blood washed off his face, **all signs of the operation must be removed.** The instruments and anæsthetic apparatus, blood-stained basins, sponges and towels should be taken to the bathroom and washed. All the teeth should then be gathered up, the paper on the floor picked up (the soiled pieces being placed inside the clean) and sent to be burned. When everything is in order, relatives may be allowed in to satisfy themselves that the patient is really alive. The tidying up after the operation is especially insisted upon, as dentists get so familiar with the sight of blood that they too often forget how repugnant it is to most lay people. Many a time I have heard people recall with horror, perhaps years afterwards, the blood-stained towels and water that had been left about after some relative had had teeth extracted. The last thing to do is to see by examining the basin that hæmorrhage has ceased, and to pull down the blind to induce sleep.

Before leaving the house **the following instructions should be given :—**

1. The patient is to be disturbed as little as possible, and if he goes to sleep, so much the better.
2. He is to be kept on his side, so that blood and saliva can flow out of the mouth instead of being swallowed.
3. He is not to wash out the mouth, unless he wishes to, and then with as little disturbance as possible.
4. He can have food **when he asks for it**, which will probably

be some hours after the operation. He can have what he wishes, but preferably something light. A cup of tea is often acceptable or soup or beef tea. Milk is not to be refused, but it is probably more apt to cause or aggravate nausea and vomiting.

5. If there is persistent nausea or vomiting, the head must be kept low. Probably the best treatment is to get the patient to swallow quickly one or two large tumblers of hot water, but a large basin should be in readiness, as the water may be immediately returned with great violence, bringing with it blood and saliva-laden ether, should they have been swallowed. In other cases the water is not returned, and the feeling of nausea as a rule quickly passes off.

6. The bowels must be regulated for some days at least—this is a great preventive and cure of post-operative pain and promotes rapid healing. The patient may take any medicine he is used to, but rather larger doses than usual.

7. The day after the operation the patient should begin to use, and continue to use, an efficient mouthwash until the wounds have healed. The following are recommended :—

(1) **Peroxide of hydrogen** (10 volumes) is undoubtedly the best. Whatever value it may have in virtue of the nascent oxygen that is liberated, is greatly increased by the bubbling which renders it a great mechanical cleanser, expelling food and other debris laden with bacteria from the sockets. It is also a powerful deodoriser. It can be used diluted with three or four parts of hot water, or it may be sprayed over the mouth with an atomiser.

(2) **Sodii phenas or Phenol sodique** in solution 1-60 is very efficacious, and is soothing to the gums when the patient complains of after-pain or discomfort. It can be made a little weaker or stronger, according to the sensation produced in the mouth.

(3) **Formalin**, one drop to the ounce of hot water, is a powerful deodoriser and antiseptic, but is apt to sting a little at first. It is also put up in the form of very palatable tablets, which can be allowed to dissolve in the mouth.

(4) **Permanganate of potash**, although a weak antiseptic in the strength in which it can be used in the mouth, is a powerful deodoriser and has the virtue of being inexpensive for poor patients. One or two crystals, which must not be touched with wet fingers, are dissolved in half a tumbler of hot water.

Whilst admitting that there are other antiseptic mouthwashes, which, when properly used, are as efficient as these just mentioned, there are a large number of others which, anyhow in the strengths in which they are used, are no more efficacious than the hot water in which they are dissolved.

Whatever the mouthwash selected, it should be remembered that its strength is immediately weakened by the saliva in the

mouth, or by decomposition or by forming compounds with organic matter. Consequently, if a substance is antiseptic within a reasonable length of time only in a strength that is just bearable in the mouth, doubt must be thrown upon its efficacy as a mouthwash. Secondly, it is far more important to use a small quantity frequently than a large quantity at long intervals. Half a tumblerful is ample at a time. A large mouthful should be taken and by means of the cheeks vigorously washed around the mouth and drawn in and out between any remaining teeth. Each mouthful should be held in for one or two minutes. The wash should be used at least after each meal and as often between times as the patient likes. After meals, however, the tongue and any remaining teeth should be first carefully brushed, so as to lessen the need for an antiseptic at all and to give it a better chance to do its work. Lastly, heat greatly augments the power of antiseptics and deodorisers ; consequently the wash should be as hot as it can comfortably be borne. It also relieves discomfort and promotes healing.

It has already been stated that neither dentist nor patient usually views these extensive extractions as seriously as he should. It is unquestionable that the operation in itself and in its after-effects is often one which is more serious than many for which a patient would go into hospital or a nursing home for a week or more. Yet one finds that the patient is often expected to be operated on at the dentist's and within an hour or two to go home, possibly on a tram-car even in winter, and finally expects to be quite well next day and to be able to go to work or fulfil social duties. How common it is to hear that So-and-so was not himself for weeks or months after having had a number of teeth extracted, or as it is more commonly put, So-and-so did not get rid of the anæsthetic for months after the operation. No wonder ! A considerable experience of the evil results attending the common methods of conducting these operations has led me to urge the patient to remain in bed for at least the next day, and to keep in the house for another day or two. This treatment is so unusual that the patient often demurs ; but a little explanation and reasoning will usually convince him and his friends that if the advice be followed, he will probably be quite fit in a few days ; whilst if not, he will be fulfilling his duties indifferently well and only under pressure and discomfort. One knows that there are many who cannot follow this advice, unless perhaps the operation is on a Friday or Saturday, but those more happily situated should be strongly urged to do so.

CHAPTER V

TECHNIQUE OF EXTRACTION

IT must be admitted at the outset that the average tooth can be extracted successfully with instruments that vary greatly in shape and size and by manipulations that vary greatly in detail.

Teeth are extracted successfully with sequester forceps, necrosis forceps, with a pair of ordinary pliers, and with tooth forceps as badly adapted for their purpose as any of these. It is not sufficient, however, that a tooth *can* be extracted successfully. For instance, it makes a great difference to a patient who has had nothing to allay the pain, whether the extraction takes one second or ten. Again, supposing that there are five or six teeth to extract, it makes a great difference to him whether the dentist adopts a technique that enables the operation to be performed with a single dose of nitrous oxide, or whether the technique necessitates the prolonging of the nitrous oxide anaesthesia with ethyl chloride or ether. Lastly, the real value of a technique and the real test of the ability of the operator is not afforded by an ordinary extraction, but by a difficult one. Now, both in hospital and in private practice, the author has met with a considerable number of so-called "difficult extractions"—extractions which, almost invariably, have been difficult only because of the technique adopted. On the other hand the technique, presently to be described in detail, has been based on methods that have been eminently successful in really difficult extractions. It surely follows that a technique that is good in difficult cases must be good also in simple ones. It is seldom possible to foresee whether an extraction is going to be easy or not, and consequently it may be laid down as a golden rule in extracting, *always to proceed on the assumption that every extraction is a difficult one*. How many teeth are fractured every day, not because the extraction was difficult, but because the operator considered it an easy one! From the very nature of the operation, one can never be certain of extracting any tooth, and hence another golden rule is never to promise your patient anything except that you will do your best.

The position of the patient in the chair is of great importance (fig. 26). It is usually recommended that for the extraction of mandibular teeth, the patient should be sitting upright; but

that for maxillary teeth the chair should be tilted backwards. From this latter recommendation the author most strongly dissents—the patient should be upright and the chair in the same position for the extraction of all the teeth. The main objection to the position commonly recommended is that it greatly increases



FIG. 26

Illustrates (1) Proper posture of patient for the extraction of all the teeth—the patient sitting upright and the head in a line with the body.

(2) Patient and chair completely covered by jaconet which, together with a thick soft towel, is tucked well inside the patient's clothing.

(3) Position of anæsthetist, behind and to the left of patient, steadying the head by grasping it with both hands above the ears.

(4) The top of the patient's head is at the level of the operator's shoulder.

the risk of the operation without any adequate compensation; for it has all the disadvantages of the fully dorsal or supine posture. With the patient sitting upright, it is perfectly easy to prevent any blood or saliva getting beyond the fauces, thus lessening immediate risks and the chances of nausea and vomiting afterwards. Again, if the tooth or root falls on the tongue, it

falls on the anterior convexity and tends to pass forwards, whilst, if lost for a moment, it is usually found *under the tongue behind the incisors*—a fact worth remembering. Also, if it lies on the tongue, it is easily swept forwards or caught between the forefinger and thumb of the left hand. I always impress upon the student who has administered the anæsthetic and is steadying the patient's head, that he must, whilst watching the patient's colour and respirations, keep a sharp eye on the operator, and at the first indication of a root loose in the mouth, or at the first faint *râle* indicating that blood is passing into the air-passages, be ready to push the head forwards, until the root is found, and if necessary, bend the body right forwards from the hips. Now it is practically impossible to do this, with a patient in the semi-recumbent posture, and even turning the head to one side in that posture does very little to remedy the position of affairs. Again, during the induction of the anæsthesia, especially if ether be given alone, in mixture or in sequence, the recumbent or semi-recumbent posture is not to be compared with the sitting, because there is usually more or less salivation, and if the ether-laden mucus be swallowed, it greatly conduces to after-nausea and vomiting. It is also impossible to breathe and to swallow at the same time, and so ineffectual attempts of the half-anæsthetised patient to do so greatly hamper the anæsthetist, markedly prolong the induction and may lead to very undesirable complications.

As soon as the second stage of anæsthesia is entered on, the patient should, if necessary, be put into the bent-forward posture, whilst the head is maintained in the axis of the body so as to let the saliva run into the facepiece from which, if excessive, it can be allowed to escape into a basin, by lifting the facepiece from the chin for a moment. Even for the extraction of maxillary teeth there are no drawbacks to the sitting posture, and a dentist, who has been in the habit of tilting the chair, becomes quite reconciled to the sitting posture after one or two trials. That the reclining posture with the head thrown back is not safe even with a conscious patient, is proved by the death of a man from pulmonary complications following the dropping of a root into his pharynx. Probably the patient was inspiring at the moment and the root passed directly through the widely-opened glottis into a bronchus. To sum up, the chair and head-rest should be adjusted so that the patient is sitting comfortably upright, with the head poised on the shoulders, neither thrown backwards nor forwards.

It is advisable to remove the foot-rest, especially if the patient is a muscular man. Should there be any struggling, it affords him enormous leverage, and this may seriously interfere with the

conduct of the operation. Another reason for removing it is that in the author's own experience, a head-rest has been broken by the pressure able to be put upon it, owing to there being a rigid foot-rest; whilst three foot-rests have been smashed off. In one case during the induction of nitrous oxide anæsthesia, a man sitting perfectly still suddenly raised one foot and stamped it down on the foot-rest of a new chair that was being used for the first time and snapped it clean off, although there was no visible flaw. There was no struggling and the patient, who was quite unconscious of his action, was rather proud of his work afterwards! If the foot-rest cannot be removed, it should, if possible, be pushed in and the patient's legs extended, so that the lower parts of his legs rest on it, whilst the feet project beyond. If the foot-rest be immovable, the patient should be asked to hang his feet down on each side of the foot-board or to rest them on the floor there, or they may be gently put into that position, immediately it is quite certain that he is unconscious.

His clothing having been loosened and protected from being soiled, he should be asked to *clasp his fingers comfortably together under the jaconet*. This direction, like many others given in this book, may appear trivial, but it is one that at times is of the greatest moment to the operator. If the patient be allowed, as is so often the case, to grip the arms of the chair, one finds that, if any struggling takes place, he usually puts up his arms, and if there is not adequate assistance, a very slight resistance on his part may quite impede the operator. On the other hand, if he starts with the hands clasped, he will often confine his struggling to gripping his hands very firmly together, straightening his arms and raising them slightly from his lap.

Finally the height of the chair should be so adjusted as to suit the extraction of both maxillary and mandibular teeth. If the operator is right-handed, the height will be determined by whether or not there are right mandibular teeth to be extracted. In order to reach these teeth, he needs to be raised well above the patient, and if he stands on the floor, the chair must be placed probably as low as it will go, and this is inconveniently low for the extraction of other teeth. Consequently, it is better for him to have a small, curved, wooden platform, on which he can stand to extract these teeth, so that he can adjust the chair comfortably for the extraction of all the rest. Fig. 27 shows such a stool, 8 inches high, 12 inches broad, and 36 inches long, but the last measurement could quite well be 24 inches. It is still better to be or to become absolutely ambidextrous; for valuable as it is in the extraction of teeth, it is a hundred times more so in filling them. Apropos of this, does it not seem ridiculous that practically the whole civilised race should go through life as one might say "on

one arm," and yet a man who attempted to hop through life on one leg would probably be taken care of as a harmless monomaniac.

The dental chair then should be so adjusted that **the top of the patient's head is at the level of the operator's shoulder** (fig. 26). In a private house, where there is a choice of arm or cane chairs, a low one should be preferred, in order to reach comfortably the right mandibular teeth, and if this should bring the patient too low for the maxillary teeth to be extracted, the operator will find that kneeling on one knee will afford him a perfectly comfortable position. Lastly, he should give a quick glance around to see that he has at hand everything needed for the particular operation. If a general anæsthetic is to be adminis-



FIG. 27

Platform (photographed on its side) on which to stand for the extraction of right mandibular molars.

tered, the mouth prop is now placed in position *between the central incisor teeth* (or between the gums in that region, if the teeth are absent), unless this site is contra-indicated by the presence of a filling or a crown which might be damaged.

In what order shall the teeth be extracted? If the operator is not really expert, he should undoubtedly first extract the tooth that is giving rise to the greatest discomfort, especially if it is one that is likely to present any difficulty. It is not much consolation to the patient to be told on recovering consciousness that three quiet molars have been extracted, but that there was not time to get out the fourth, which maybe was aching viciously at the time of the operation!

If the teeth to be extracted are scattered all over the mouth, and if there is no contra-indication, it is better to extract in the following order:—

- (1) Left mandibular teeth—from the left side of the chair.
 - (2) Right mandibular teeth
 - (3) Maxillary teeth
- } from the right side.

This order, however, does not apply, if a complete clearance is to be made (see page 47).

Exception is often taken to this advice **to extract left mandibular teeth from the left side of the chair.** One objection is, that most dentists being "one-handed," the side of the chair on which they habitually stand has free space; whilst the other (usually the left) is occupied with fixtures such as a spittoon and bracket-table, which in some cases are so arranged as to make it impossible to operate from the left side. It is also urged that it is unnecessary, as one can easily reach across the patient from the right side, especially if the assistant turns the head well towards the operator, and that it also obviates the necessity of moving to the other side of the chair to extract the remaining teeth, and so saves time. There is no denying that there is a great deal of truth underlying this objection, but still I maintain that over a series of cases, operating from the left side will prove to be quicker. I must admit that in many cases the molars on the left side can be as well extracted from the right side of the chair as from the left. One must, however, be governed by the principle that one's conduct should be guided not by the 80 or 90 per cent. of successes but by the 20 or 10 per cent. of failures. In deciding what routine method of operating to adopt out of the possible half-dozen methods almost equally successful, one should choose that which is known to give the greatest percentage of successes. Now it has been my lot to see a large number of left mandibular molars extracted without difficulty from the right side of the chair, and in these cases a second or two has possibly been saved. On the other hand I have frequently seen the extraction attempted from the right side, and after perhaps fracturing the remains of the crown, the operator make another attempt standing in front of the patient, and then, if unsuccessful, passing quite to the left side. This inclination to get to the left side in difficult cases is my chief reason for advocating this position to start with. Again, although I have no statistics with which to attempt to prove the statement, there is no question that one meets with fewer "difficult extractions" of left mandibular molars, when they are attempted from the left side in the first instance—simply because of the slightly greater mechanical advantage that the operator has. Now I hold that the convenience of operating from the right side in the successful cases, admittedly in the majority, does not in any way compensate for the loss of time in the unsuccessful ones. As a matter of fact, a long experience in teaching students, in which many different methods have been

given a trial, has abundantly proved that the time consumed in passing from the left side of the chair to the right to perform the remaining extractions is more than saved by the greater rapidity and certainty obtained by standing on the left side.

The anæsthetist, having laid aside his apparatus, can very materially aid the operator, without in any way interfering with his primary duty of looking after the welfare of the patient. In all cases except during the extraction of right mandibular molars, he should stand directly behind the patient's left shoulder and grasp the head firmly between his two hands, the palms being placed above the mastoid region and the fingers extended on the temples (fig. 26). This position enables him to keep the head rigid with the expenditure of the least amount of energy and without in any way interfering with the area of operation. It also enables him readily to turn the patient's head to right or left, as the operator may desire, and to counteract, by forward pressure from the palms, any tendency to over-extension of the neck on the part of the patient. Lastly, whilst noting the patient's respirations and watching the state of the circulation as reflected in the face, he should, to repeat what has been said before, watch the manipulations of the operator, and if a root is lost in the patient's mouth, should before the operator has time to say so, gently but quickly bend the head on to the chest, so that it may gravitate forwards, this position by forcing back the root of the tongue still further protecting the avenues to the air-passages. Should the operator not immediately find the foreign body, the anæsthetist should go still further and, whilst keeping the head flexed, should forcibly bend the patient's whole body forwards from the hips.

The operator stands on the left side of the chair about opposite the patient's knees, and facing directly backwards, that is, a line drawn through his hips is at right angles to the chair. His left thigh is pressed against the arm of the chair, and his body is bent to the left and slightly forwards to bring his face into line with the patient's face, which the anæsthetist turns slightly towards him.

The conduct of the left hand is all-important (fig. 28). The mouth prop is in the middle line and the operator passes the forefinger and thumb of his left hand into the patient's mouth, the forefinger on the far side and the thumb on the near side of the prop. These are inserted far enough to enable him to *grasp the alveolus of the tooth which he is about to extract*. The novice usually flexes the interphalangeal joint of the thumb and engages it at the commissure of the lips. On the contrary, the joints of finger and thumb should be almost extended and the patient's cheek should cover the thumb. Almost simultaneously with

the insertion of the finger and thumb, the other three fingers of the left hand should be flexed to grasp the lower border of the mandible, care being taken, however, that the tips of the fingers do not press up the floor of the mouth and the base of the tongue, as this causes discomfort to a conscious patient and impedes respiration in an unconscious one. This position of the left hand affords many advantages over that usually advocated. (1) The forefinger and thumb by displacing the tongue and cheek

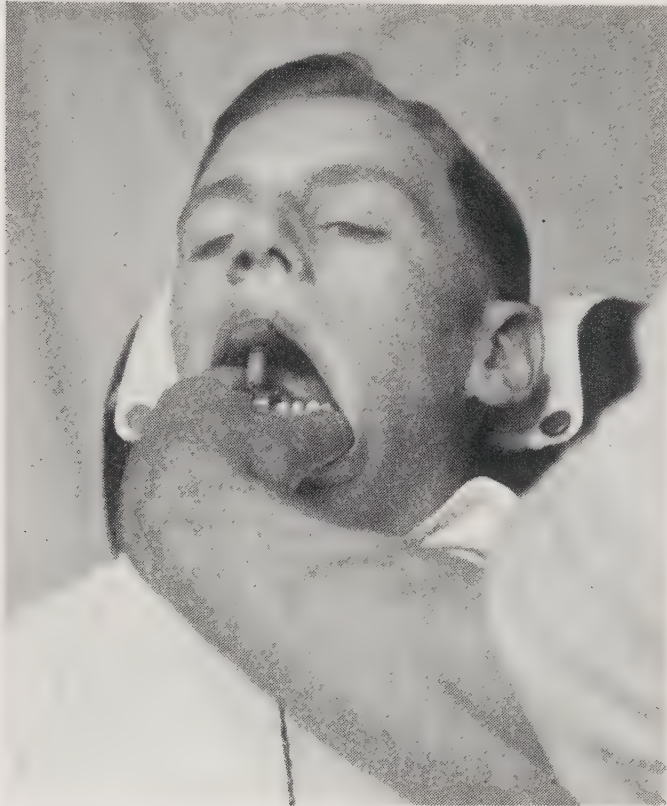


FIG. 28

Position of prop and conduct of left hand in extracting left mandibular molars and premolars. The forefinger and thumb firmly grasp the alveolus of the tooth to be extracted. The middle, ring, and little fingers are folded under and grasp the lower border of the mandible.

completely expose the operation area to view. (2) The power of opposition between forefinger and thumb enables the operator to grip firmly and so support the alveolus during the extraction, thus minimising the damage done to bone and gum. (3) The same power of opposition enables the operator to catch at once between finger and thumb, which are ready on the spot, any loose tooth or root or fragment of crown, which may be lost out of the forceps. If the fore and middle fingers are put into the mouth and the thumb under the mandible, as usually taught,

the operator has to remove his fingers and then insert finger and thumb to catch hold of a root that has been lost, and meanwhile the patient is in danger, and time is wasted. (4) A root that has been loosened can often be steadied between finger and thumb, whilst the forceps are being reapplied. (5) The tongue and cheek are protected from any possibility of being nipped between the forceps and tooth, an accident that happens not infrequently when operating in the orthodox style. (6) The three fingers under the mandible afford ample and easy support to counteract the downward pressure exerted by the right hand through the forceps, whilst in conjunction with the thumb and forefinger a very powerful grip of the mandible is obtained, enabling the operator with the greatest ease to move the patient's head in any direction he pleases to suit his convenience in operating.

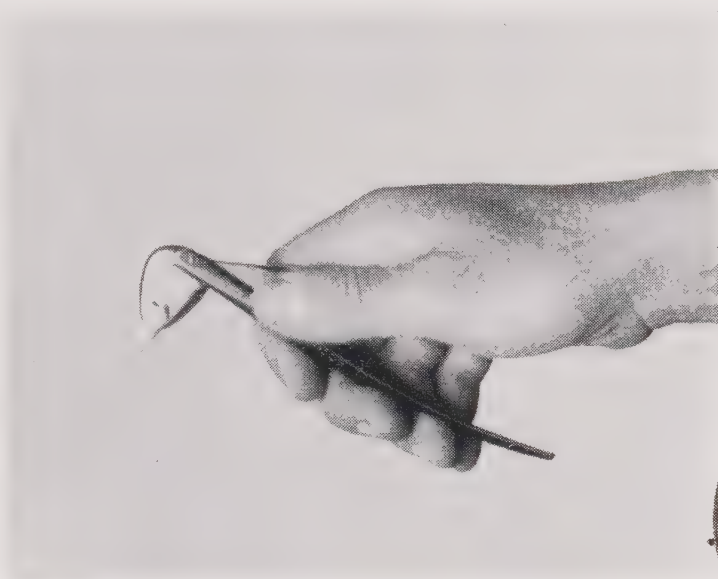


FIG. 29

Correct grasp of the lower forceps near the joint. The little finger may not comfortably reach the lower handle and is then flexed under the upper one.

The forceps, as shown in the photograph (fig. 29), are held somewhat near the joint, the pulp of the thumb being in the angle formed by the two handles, with the upper handle lying under the first phalanx of the forefinger and in the palm of the hand. The fore, middle, and ring fingers support and grip the lower handle, whilst the little finger, being usually too short to reach it, is flexed under the upper one. Many operators hold the forceps too far from the joint, arguing that it increases their leverage. Considering, however, that the lever is the whole length of the operator's arm, the extra one or two inches gained is not worth considering, as the leverage is a hundred times more than sufficient. On the other hand, the whole difficulty in using the forceps is to prevent the lingual blade moving crownwards, when leverage is applied; and hence the frequent advice to place at least one finger of the left hand firmly on the top of the lingual blade to keep it down. This, however, if the forceps are held close to the joint, is quite unnecessary.

The mouth is not as a rule sufficiently widely opened to enable the blades of the forceps to be introduced in a vertical position, hence they should be introduced horizontally, blades first. When past the lips, the blades should be opened and having been turned vertically downwards should be applied to the root or tooth to be extracted. In this connection it should be remembered that the mandibular cheek teeth, especially the molars, have an inclination towards the tongue; consequently, in order to allow the lingual blade to grip the neck of the tooth and enter the socket, the operator's elbow must be raised, often to a considerable extent.

In extracting a molar, the blades should be applied, not to the middle of the tooth between the roots, but towards the mesial

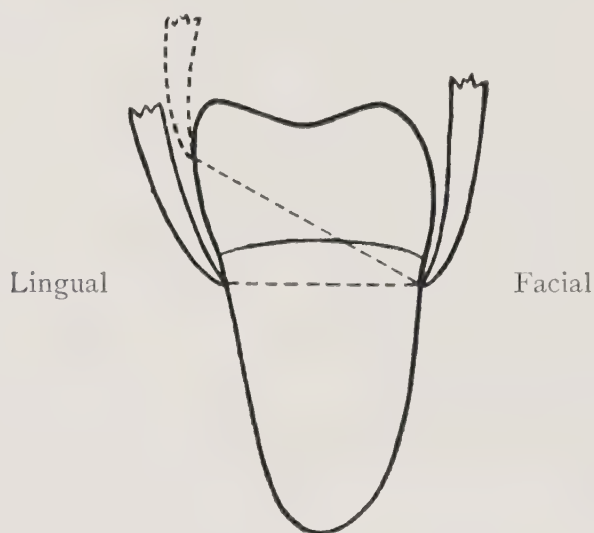


FIG. 30

Represents mandibular molar to illustrate effects of allowing the lingual blade to move crownwards, which can only happen by allowing the handles to open. By turning the book upside down the same illustration will serve to represent a maxillary molar.

or distal end so as to engage a root, and preference should be given to the root which presents the better hold for the forceps lingually. The blades thus applied, the root gripped must come away, and if the union with its fellow is sufficiently strong, it will come too. The facial blade, having been properly placed at the neck of the tooth, will look after itself, every manipulation tending to drive it into the socket.

The forceps having been correctly applied (fig. 30), the operator, by keeping his wrist rigid, exerts considerable downward pressure from the shoulder on to the blades of the forceps, driving them into the socket. Simultaneously the elbow is lowered, and the wrist being rigid, leverage in an outward direction is applied to the forceps and should be transferred through them to the root.

This, however, will only occur, if the operator exerts sufficient pressure on the handles to cause the blades firmly to grip the root, and herein lies the secret of many a fractured tooth. Sufficient pressure must be exerted upon the handles to *make the tooth part of the forceps*. The inexperienced operator, when depressing the elbow, often allows the lingual blade to rise up from the neck of the tooth, and this can only happen by allowing



FIG. 31

Conduct of left hand in extracting mandibular premolars, canine, and incisors on right side. Operator stands on platform. Thumb and forefinger grasp alveolus, with prop, if present, between them. The remaining fingers firmly support mandible by being flexed under the lower border. In extracting the molars, the forefinger and thumb grasp the alveolus further back, the forefinger being covered by the cheek.

the handles of the forceps to open. As students often deny having allowed the handles to separate, it may be pointed out that the distance between the blades is greater when the lingual one moves up from the neck than when it is kept down in the socket, proof positive that the handles must have been allowed to open. The result is disastrous, for either the lingual blade slips right off or a lever of the first order is instituted, and the lingual wall or even the crown of the tooth is snapped off, and consequently the difficulties of the extraction are enormously increased (fig. 30).

For the **extraction of the right mandibular cheek teeth**, the right-handed man stands closely behind and a little to the right of the patient upon the kidney-shaped stool and bends his body forward over the patient's right shoulder (fig. 31). The anæsthetist stands on the left side, out of the operator's way, and does not support the patient's head, the operator doing this for himself with his left arm. The conduct of the left hand is exactly the same as in operating on the left side, viz., the forefinger and thumb are passed into the mouth and grip the alveolus of the tooth to be extracted, whilst the three remaining fingers

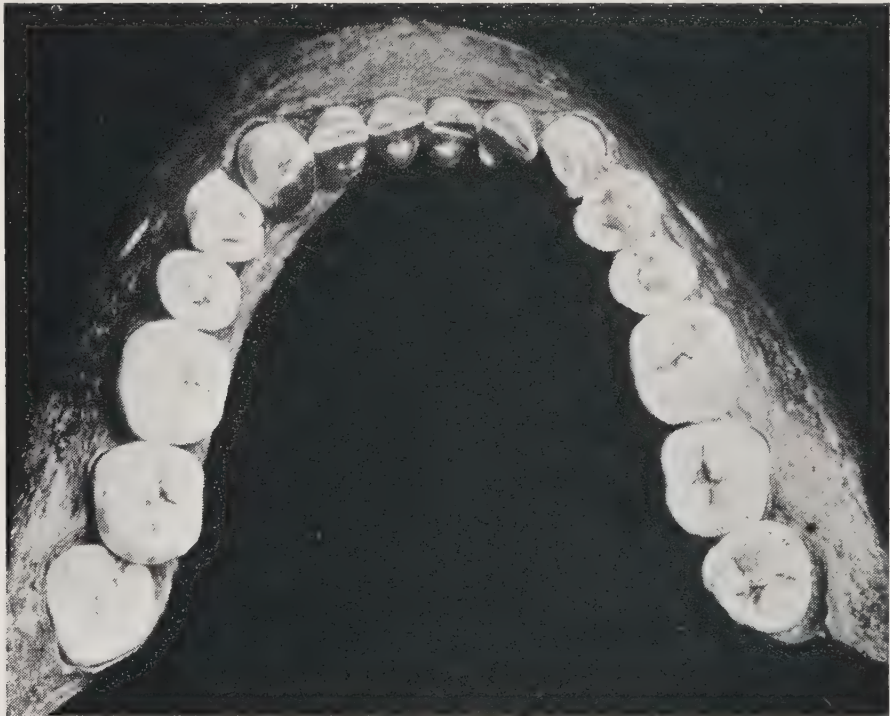


FIG. 32

The mandibular teeth *in situ*. Shows the lingual inclination of the molars and premolars, and the progressive increase in thickness of the bone on the facial aspect from the premolars to the third molar. The left third molar is partially impacted.

grasp the lower border of the mandible. The only difference is that the thumb is now on the lingual side of the alveolar arch and the forefinger on the facial. The forceps are applied and used exactly in the same way as in the extraction of teeth on the left side. Even a cursory examination of a mandible will show that the alveolus on the facial side of the molars and especially of the third molar is very much thicker than on the lingual side (fig. 32). This anatomical fact has led to the belief—absolutely unsupported by experience—that these teeth and particularly the third molar are unsuited for removal by being simply levered facially. This arm-chair teaching becomes still more dogmatic

when dealing with molars in which the tilt lingually is pronounced, it being commonly taught that "straight" forceps should then be used, and that an "inward movement" *must* be imparted to the tooth.

Experience abundantly proves that any attempt at "inward movement," especially with instruments of the hawk's-bill type, is not only unnecessary and almost invariably futile but impossible, unless the patient's jaws are very widely separated, and even then the handles of the forceps at once come in contact

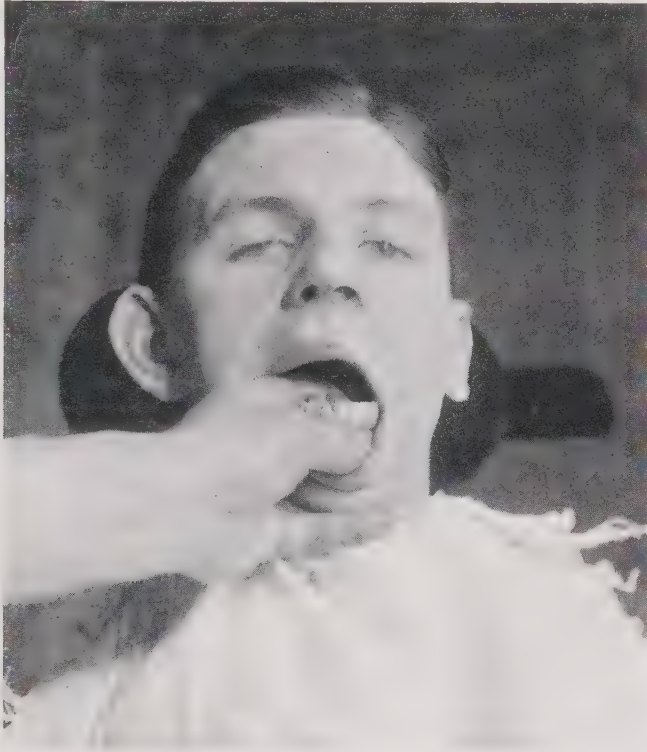


FIG. 33

Conduct of the left hand in extracting the mandibular canines and incisors. The alveolus is grasped between the forefinger and thumb, the other fingers being flexed under the lower border of the mandible, which they support.

with the maxilla. To sum up: any mandibular molar that is not tilted lingually too far to allow of its being grasped by forceps of the hawk's-bill type—and those that are so are rare indeed—are best extracted by a steady leverage facially.¹

Mandibular premolars are also extracted in exactly the same way as the mandibular molars, the alveolus being firmly grasped by the left hand and the tooth carried facially by one movement of the right arm. It will be noticed later on that these roots are apt to break half-way in the socket, and so, as the root is conical

¹ Should the third molar be tilted too far lingually to be grasped with the lower forceps recommended in this book, it can be extracted with the upper forceps introduced through the opposite corner of the widely-opened mouth, or with "straight" root forceps.

in shape, the dentist should, if there is much resistance to facial movement, combine with it slight rotation—just as in the case of the maxillary incisors and canines.

With regard to the **mandibular front teeth**, if it is a case of a complete clearance, the teeth on the left side as far as the canine should be extracted from that side, and then the operator should pass to the right side and extract the remaining teeth. If, however, the mandible is edentulous save for the front teeth, he should stand on the floor on the right side of the patient and grip the alveolus between the forefinger on the lingual and the thumb on the facial side, whilst supporting the chin with the three remaining fingers (fig. 33). Owing to chronic inflammatory changes the gum may be readily torn in extracting these teeth, and the alveolar plates being weak are easily fractured, resulting perhaps in ugly wounds that may cause considerable pain and heal somewhat slowly. These results may, however, almost invariably be prevented by exerting *very* great pressure with the left forefinger and thumb, whilst the teeth are being extracted, thereby supporting the gum and alveolus. The forceps are held in the right hand as usual, the blades being applied accurately to the neck of the tooth to be extracted and pressed firmly into the socket. The elbow and wrist are kept rigid and the arm depressed. If simultaneously the operator compresses the handles tightly enough to prevent the lingual blade rising up, as owing to the shape of these teeth at the neck it is apt to do, if, in other words, he obeys the golden rule to “make the tooth part of the forceps,” the tooth is levered outwards and removed from the mouth.

An ambidextrous operator stands on whichever side is more convenient and completes the operation from the one position, although it is better to change sides. For instance, if he stands on the right side facing the patient for the extraction of the teeth on the left side, he holds the forceps in his right hand, and the patient's head being turned towards him, he grips the alveolus with the left forefinger on the lingual side and the thumb on the facial. To extract the teeth on the right side without changing his position, he holds the forceps in his left hand and grasps the alveolus between the forefinger (lingually) and thumb (facially) of the right hand.

The same principles govern the **extraction of the maxillary teeth**. These normally occupy a larger arch than the mandibular teeth and are tilted facially—a fact of some importance in the operation (fig. 34). The operator stands on the floor on the right side of and facing the patient. The prop is placed preferably between the incisor teeth. The manner of holding the forceps is of prime importance, as upon this depends largely

the ease and success of the operation. It frequently falls to my lot to extract a maxillary molar with comparative ease, even after it has been mangled out of all recognition, simply because in the technique about to be described all the energy used is applied immediately to the tooth and not, as is the case when forceps are held as usually taught, mainly directed to preventing the hand from slipping up the handles. Of course, for the extraction of an easy tooth, it possibly does not matter how the forceps are held; but the test of the technique comes to all of us sooner or later, and the method that suffices for a difficult extraction simply makes an easy one easier still. The photograph shows clearly

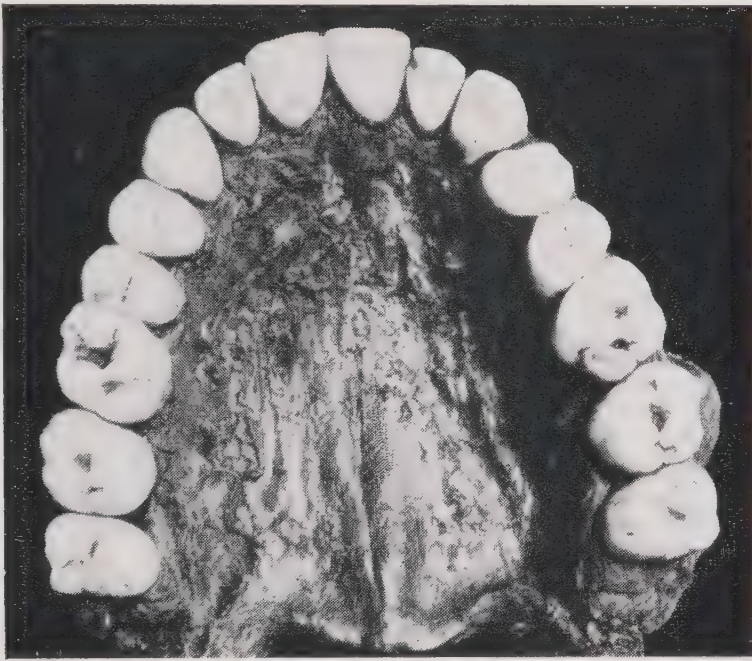


FIG. 34

The maxillary teeth *in situ*. Shows the facial inclination of these teeth. Dr J. Ryland Whitaker's Museum, Surgeons' Hall, Edinburgh.

the method advocated (fig. 35). It will be seen that the forceps are held by the ends of the handles. The end of the one handle is placed in the centre of the palm and held there by flexing the forefinger upon it. The thumb and three remaining fingers are stretched across to reach the other handle and to control it, the hand being at the same time ulnar-flexed. There are many advantages in this grip, the principal one being the entire absence of any tendency for the forceps to slip through the hand—this can be demonstrated at any time by ramming the blades of the forceps thus held, against a wall. Consequently, the only work the flexors of the fingers have to do is to compress the handles together, just firmly enough “to make the tooth part of the

forceps'' ; whilst the far greater amount of energy often required to force the lingual blade along the lingual root is transmitted through the arm, forearm, and hand, from the much more powerful muscles of the shoulder-girdle. The release of the flexor muscles of the fingers from any share in the forcing of the forceps into place, allows the operator to use them with far greater delicacy in adjusting the pressure required to keep the handles

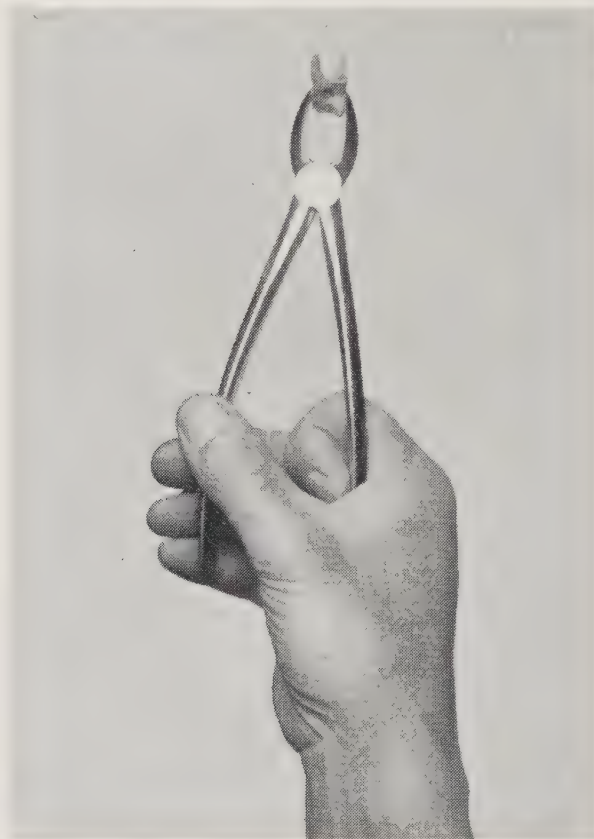


FIG. 35

Correct grasp of the upper forceps—near the ends of the handles. The end of one handle is in the middle of the palm, and is held by the forefinger flexed round it. The three remaining fingers and thumb grasp the other handle and regulate the pressure on the handles. The pressure on the forceps is transmitted through the palm.

closed against the resistance offered by the tooth to lateral movement. Again, the position of the hand allows of a very clear view of the field of operation ; whilst owing to the handles being compressed far away from the joint, a very slight pressure produces an enormous effect on the blades—in other words, the forceps are being used to the best mechanical advantage.

In **extracting maxillary teeth then from the left side** of the mouth, the alveolus is grasped between the thumb of the left hand on the

lingual side and the forefinger on the facial side, over the roots of the tooth to be extracted (fig. 36). The commissure of the lips should not be pushed back by the forefinger, which should be covered comfortably by the cheek. With very little practice it should be possible for the operator easily to make the tips of forefinger and thumb meet behind the third molar, without causing any discomfort even to a conscious patient. Care must be taken to keep the rest of the fingers almost extended, for if flexed, there is danger of their pressing upon and perhaps damaging the patient's eye. The conduct of the left hand is of the

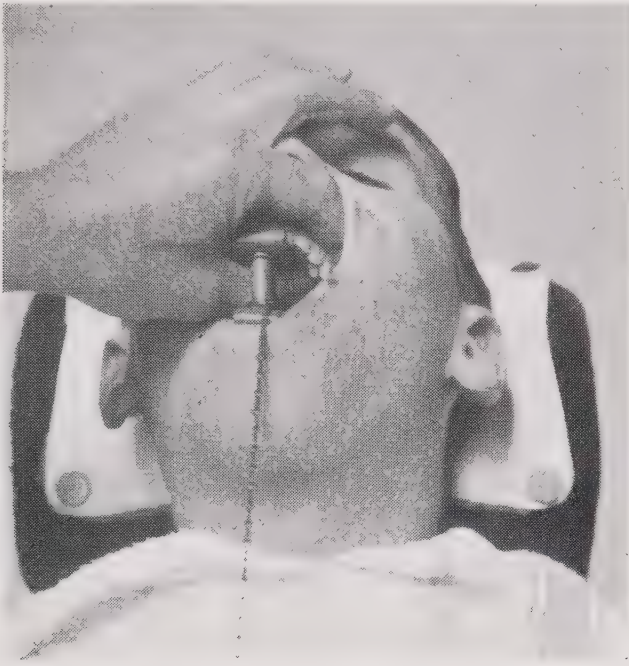


FIG. 36

Shows conduct of the left hand in extracting left maxillary molars and premolars. Prop in the middle, thumb on the lingual side, and forefinger on facial and covered by the cheek.

(The head has been thrown back somewhat in order to get a clearer photograph.)

greatest importance in rapid and safe operating; for should a root slip from the blades of the forceps, it can immediately be caught between the forefinger and thumb or be guided out of the mouth by closing them behind it. One needs very little experience to learn the tendency there is for conical-rooted third molars thus to slip out of the forceps, and the danger there is of their passing into the pharynx, if the orthodox method of extracting is adopted. So true is this, that a very clumsy pair of forceps has been devised, with a bulbous receptacle in the blades for the extracted tooth to drop into. The surgeon, however, who has learnt to operate with the patient sitting upright and who has

also learnt to use his fingers has no need to rely on such aids, even if they were always at hand.

In **extracting on the right side** of the mouth, the conduct of the left hand is precisely similar, except that now the thumb is in the cheek and the forefinger on the palate (fig. 37). In extracting the front teeth, the left forefinger is applied to the gum over the roots of the teeth, the upper lip falling over it, and the thumb



FIG. 37

Conduct of the left hand in extracting right maxillary molars and premolars. Prop in middle line, thumb on facial side, forefinger on lingual, firmly grasping alveolus. Note that the cheek is not forced back by the thumb engaging the commissure of the lips, but covers the thumb. See forefinger, fig. 36.

is applied to the lingual side. It will be noticed that at least as good a view of the field of operation is obtained thus, as by the method usually taught of placing the forefinger and middle finger, one on each side of the alveolus; whilst it has two further great advantages. Firstly, as has already been pointed out in the extraction of mandibular teeth, the two digits that are best capable of opposition and prehension are already in position to catch any root or fragment of tooth that may be loose in the mouth. The saving of time thus effected can be best appreciated

by those who, by a faulty technique, often spend half or even the whole of an available nitrous oxide anæsthesia in hunting in the mouth for a root, which probably need never have been dropped at all, and the rest of the day in cursing their bad luck. Nothing need be said of the feelings of the patient, who wakes up to find practically nothing done or, worse still, to find the dentist, who has now happily found the missing root, feverishly trying to finish the operation. Secondly, if the thumb and forefinger are used in the mouth, the operator stands quite clear of the patient—an obvious advantage in dealing with the verminous and unwashed. Standing as he does well in front of the patient in an easy and comfortable position, he obtains an excellent view of the tooth to be extracted, whilst the right arm works freely from the shoulder as a long and almost straight lever. If, however, the left middle finger and forefinger are in the mouth, the operator rests the wrist and lower part of the forearm on the head of the patient, and consequently stands huddled close up to him in a cramped position, so that the right arm and hand have no free play to do the actual extraction.

If all the maxillary teeth are being extracted, a time comes when it is necessary to reverse the position of the forefinger and thumb. All the teeth on the left side and the front teeth up to and including the right lateral incisor are extracted with the forefinger on the facial, and the thumb on the lingual side of the alveolus. Those on the right side up to and including the canine are extracted with the thumb on the facial and the forefinger on the lingual side of the alveolus, the patient's head being turned well to the right side for the extraction of the canine.

A consideration of the number and shape of the roots of the maxillary teeth, of the alveolar plates, and of the position of the mandible will indicate the most rational movements for the speedy and effectual removal of the roots. The molars and premolars have either multiple roots or a root somewhat flattened, so that rotation is contra-indicated in both cases. The six front teeth (incisors and canines) have single, somewhat conical roots, and rotation is not only possible but a great help in loosening them. One has to make only a cursory examination of the alveolar process to see that throughout its length the facial plate is thinner and weaker than the lingual—in fact, the facial plate may be absent, either wholly or in part, as a result of disease or of anatomical peculiarities. Lastly, and this is most important, the fact that the body of the mandible forms a much larger arch than the maxilla renders any effective inward (lingual) movement of the teeth impossible, except in the case of the front teeth. Any attempt to “carry the tooth inwards” only results

in bruising the lower lip between the handles of the forceps and the mandibular teeth. Most practitioners make an attempt to rock all the teeth lingually, and some make an inward movement the only one in the loosening of the front teeth. There are a number, too, who in extracting any tooth in the mouth with a pair of forceps, shake it inwards and outwards with a velocity of movement, which cannot but excite admiration in the onlooker, but which does not produce results commensurate with the energy displayed, nor with the breathlessness and exhaustion exhibited by the operator.

Consider the question from a purely mechanical standpoint, and take the case of the average maxillary molar with three roots. The lingual root is embedded in the comparatively thick bone of the palate, the bone being thickest at the apex and thinning out to an edge at the neck of the tooth. The lingual root also diverges from the crown towards the middle line of the palate. The facial alveolar plate is usually thickest and strongest over the apices of the roots, but may be strongest at the neck, the bone being thin or even absent in the region of the apices, or the plate may be more or less equal in thickness over the length of the root. Now, supposing that in any of these combinations of circumstances, an operator grasps the neck or roots with a pair of forceps and follows the instructions to "apply force first slightly inwards" (Tomes, Smale and Colyer) to loosen the buccal roots. I have personally never seen the buccal roots loosened by this movement; and it is quite obvious from the succeeding sentences of the authors quoted that they have no deep-rooted faith in its efficacy. "This movement should be in fact only just perceptible; for the nature of the parts precludes the possibility of its being carried far, and perseverance in this direction will lead to disaster. The force should then be directed downwards and outwards in the axis of the internal root. If these precautions be observed, no difficulty will be found in removing the superior molars" (Tomes). Mr Tomes does not state wherein the disaster would lie; but, if his experience has been mine, he would say that if the inward movement is persisted in, long before there is any movement at all, the crown is broken off or the patient's lip is bruised by the forceps. It is inconceivable how anyone, who has ever studied the relationships of the parts, could give such instructions, and more inconceivable still how generation after generation of practitioners can be so unobservant as not to see their futility. With regard to the front teeth, there is no question that they can be loosened by an inward movement; but it requires much greater force than with an outward movement, more breakages result, and the lower lip is more liable to be bruised. A glance at fig. 38 will render the

matter clearer. In *A* the tooth is pressed lingually against the palatine process, with a tendency to drive the apices of the facial roots through the alveolus. If the intention of the operator is to widen out the cervical region of the socket, he has chosen to bend or fracture the strongest wall—the palatine. In *B*, however, if the crown is moved facially, pressure is brought to bear against the thin outer plate and against the thinnest portion of it. In this way the minimum amount of force is sufficient to widen out the socket, and in addition the lingual root, being straight or curved facially towards its apex, is simultaneously withdrawn from its socket in the direction of its axis.

The extraction of teeth or roots from the maxilla is conducted thus. The left forefinger and thumb grip the alveolus over the tooth to be extracted. The forceps are held as indicated above (fig. 35), and the blades are applied one to the lingual and the other to the facial aspect of the neck of the tooth. **In the case of the molars and premolars** firm steady *upward* pressure is made, and whilst maintaining the upward pressure the tooth is moved steadily outwards in one movement by the operator's abducting his right elbow for a tooth on the patient's left side and adducting it for one on the patient's right. It is a common fault for those learning this technique to relax the upward pressure as soon as the outward movement is begun, with the result that the lingual blade slips—the movement should be a *combined upward and outward one*.

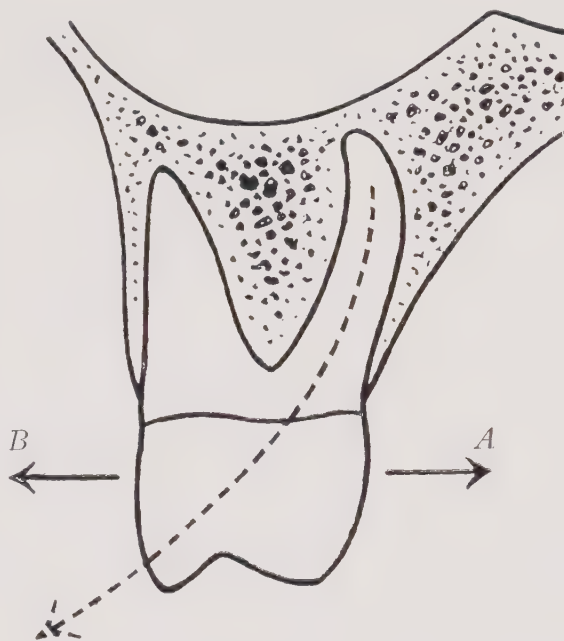


FIG. 38

To illustrate the advantages of applying force only in a facial direction in extracting maxillary molars.

The **six front teeth** are extracted by a combination of rotation and slight outward (facial) movement. In performing rotation a firm grasp of the tooth must be taken, otherwise the forceps simply rotate on the root, instead of the root rotating with the forceps. In accordance with the plea for precise movements, rotation should not be a recurring succession of supinations and pronations of the forearm. The act of supination is much more powerful than that of pronation, and if the operator after firmly grasping the root steadily supinates at the same time that he

slightly raises the elbow, there will rarely be any difficulty in extracting these roots. The conduct of the left hand in extracting these teeth is shown in fig. 39.

The education of the muscular sense is here as in other extractions of great importance. In all extractions the operator, having once grasped the tooth, should be able to detect immediately the slightest inclination of the forceps to move on it and should also be able almost automatically to correct it, by exerting



FIG. 39

Shows conduct of left hand in extracting maxillary incisors or canines. The prop can be placed in the middle and removed, or at one side, preferably the left, as it is less in the way than on the right.

the necessary, but not more than necessary, pressure on the handles.

Of the maxillary teeth the easiest to extract are the incisors and third molars. The implantation of the latter is almost always feeble, and the only difficulty lies in their position.

The tooth that is most liable to fracture is the first premolar—in fact, its extraction is attended with a greater amount of uncertainty than that of any other tooth in the mouth. The reason is that it has usually two long slender roots, implanted in thick alveolus and one at least (usually the facial) is apt to fracture;

whilst it is not uncommon for the tip of each root to remain behind.

The canine is the tooth that usually requires the greatest amount of muscular exertion for its extraction, and at times this may be considerable. More so in its extraction than in that of any of the others, is it necessary to exert all the pressure on the alveolus with the left forefinger and thumb, of which the operator is capable, particularly so if the teeth on each side of it have been already extracted. If considerable pressure is not exerted, it is very common for a large piece of external alveolar plate to be fractured and remain firmly adherent to the root (fig. 51). This prolongs the time of healing, during which there may be a good deal of pain or at least discomfort, and also leads to subsequent greater flattening or actual depression of the alveolus at a point where æsthetic considerations demand all the prominence possible. The reason for this accident is that owing to the length and prominence of the root, its attachment to the bone by the pericementum is a strong one, and the bone over it (canine eminence) for a short distance along each side is dense, becoming more cancellous over the lateral incisor and premolars. The attachment of the bone to the mucoperiosteum on the other hand is a loose one, and consequently, when the canine is rotated or moved facially or both, the bone covering it moves with and as part of the tooth beneath the mucoperiosteum, which may be badly lacerated in the process. If, however, considerable pressure be exerted over this facial plate, the attachment of the mucoperiosteum to the bone is reinforced and remains intact, whilst solution of continuity occurs, as it should, through the pericementum. This matter will be referred to again under "Accidents"; but it may be pointed out that *this common accident is almost invariably preventable* and therefore should not occur.

Let it be emphasised that there is no snapping at the tooth, no jerking and no pump-handle action. Above all, there is no pulling; and this tendency to pull is one of the greatest difficulties the learner has to overcome. There must be a firm but controlled pressure of the blades into the socket until the tooth is successfully loosened outwards, when the forceps are withdrawn from the mouth with the tooth in them. Simultaneously with the removal of the tooth, *the alveolar plates are firmly pressed together* with the left forefinger and thumb. The faults that have been indicated in extracting mandibular teeth are as likely to occur in connection with the maxillary ones. Of course there is the deep-rooted, in some individuals almost ineradicable tendency to pull, a fault that precludes the possibility of ever becoming an expert operator. There is, however, ample authority for doing

so. The advice to pull at some stage or other in the operation is urged (sometimes in italics) by almost every writer on the subject. Some of the objections to pulling are these :

(1) If the tooth is pulled out suddenly or if the forceps are pulled off the tooth, there is great danger of damaging the teeth in the opposite jaw. This occurs most frequently in my experience in "pulling" mandibular molars. I have seen at least half-a-dozen maxillary molars damaged in this way. In one case the operator pulled so vigorously as to fracture off both facial cusps of the maxillary molar, and when he had recovered from his chagrin and surprise, he blamed not himself, but the mandibular molar for being pulled so easily !

(2) Combined with the advice to "pull," there is usually advice to move the tooth laterally. When moving the tooth laterally, there is always a tendency to open the handles and therefore the blades. Consequently, at this juncture the operator often has a less secure hold of the tooth than he had a moment before, and if he now "pull," both blades may come off the tooth, or, worse still, the lingual one moves towards the occlusal surface, and even if the whole crown is not fractured off, weak bits of the lingual wall are—bits that may be of the greatest value as a guide to the blade along the root, quite apart from the fact that, owing to the obliquity of the fracture, it is now much more difficult to obtain an adequate grasp of the lingual root at all. The result is that an easy extraction may become just the reverse.

(3) Most roots or teeth that need extracting are either much weakened by caries at the part grasped by the forceps, or, as in the case of teeth that have been fractured, the amount of tooth substance available for grasping is very small. Now, if the forceps are applied to the root in either of these conditions and traction made, the root must be very forcibly compressed in order to prevent the forceps from pulling off. The result is that the carious tissue is frequently crushed, whilst the root remains. The useful guide to the passage of the forceps presented even by soft carious tissue has now gone, the time occupied in the first attempt has been sheer waste, and the chances of having to make further futile attempts increase at each try, as less and less projecting tooth is left ; whilst more and more damage is done to surrounding parts—bone and gum. In the case of a fractured root, a very slight pulling off of the forceps may result in the blades altogether relinquishing their precarious hold, and at the same time may scrape off tissue that would be of the greatest value in obtaining the firm grip necessary for the successful removal of the root.

(4) If a vigorous pull be given to a fairly sound tooth firmly implanted in its socket, solution of continuity may occur, not

through the pericementum, but through the bone, large pieces of which may be fractured and brought away with the tooth. Again, in malformations and diseased conditions of the bones, such a pull may bring away a great deal more than the operator intends.

Now what about the injunction to push! *push!! push!!!* The only conceivable harm that could arise would be from the forceps being driven too far into the socket, and in the case of the maxilla, possibly into the maxillary sinus. I can only say that I have never seen such an accident happen, even in the hands of inexperienced students, and moreover such an accident should not happen; for the pressure into the socket need be and should be proportionate to the resistance offered by the root to lateral movement or to torsion, as the case may be. The more resistance there is to moving the tooth facially, the more tendency there is for the lingual blade to slip crownwards and consequently the greater the need to "push," in order to keep that blade in position. The facial blade needs no attention; for it tends to sink more and more deeply into the socket and so it obtains a more secure grasp. From the moment that the tooth is felt to yield, the pressure of the forceps into the socket is reduced, until by the time that it is completely loosened, no pressure is being exerted, and the root is simply removed from the socket in the course of removing the forceps from the mouth.

To sum up, the advantages of forcibly pressing the blades into the socket throughout the operation are:

(1) One's aim is to extract the root or roots and not the crown only, and one is more likely to do so by a technique that tends to afford a firmer grasp as the operation proceeds than by one that tends to pull the instrument off. As the tooth becomes loosened, the pressure tends to force the blades still further up the root. This is a consideration in the case of badly decayed, hollowed-out roots.

(2) The pressure of the blades into the socket acts as a wedge spreading out the alveolar plates, and so renders lateral movement or rotation of the tooth easier.

(3) In the case of conical roots, the pressure of the blades into the socket is often sufficient in itself to dislodge them. This results partly from the fact that two bodies cannot occupy the same space at the same time, and partly from the pressure of the converging blades of the forceps upon the diverging sides of the root moving the tooth in the line of least resistance, *i.e.*, out of the socket. The velocity with which a tooth in these circumstances may fly from the socket and from the forceps and the damage it may do have been already referred to. This is another argument for the posture of the patient and the conduct of the

left hand advocated in this book, as it materially lessens the chance of such a tooth flying into the pharynx.

(4) It greatly lessens the tendency of the forceps and especially of the lingual blade to be drawn off the root, when pressure in a facial direction is exerted.

(5) There is less chance of doing damage to surrounding parts, of fracturing the tooth or root and of wasting time on futile efforts, and if the patient is conscious and the parts sensitive; of causing unnecessary pain. It is impossible to lay too much stress upon the two following points:—Firstly, the total amount of damage done by driving the forceps even a little further than is necessary for the operation in hand, and so getting out the tooth at the first attempt, is always distinctly less than that done by having to make two or more attempts. Secondly, the tooth or root should be grasped sufficiently firmly to make it a rigid prolongation of the forceps, so that it partakes of every movement communicated to the forceps, whether lateral or rotatory. This can only be effectively done by a firm, steady pressure of the forceps rootwise throughout the operation. “*Make the tooth part of the forceps.*”

(6) Lastly, the anæsthetist should be responsible to the patient for his feeling no pain during the operation. Consequently, the technique of the operator is of considerable interest to him as well as to the patient. Similar cases have to be treated very differently for different operators. Thus, in order that the patient shall feel nothing at all, it may be necessary to administer ethyl chloride or even a little ether for the extraction of three average teeth, simply because the probabilities are that the operator will have two or three “pulls” at each tooth, before he gets it out. On the other hand, with an operator who follows the technique herein advocated, it would probably be quite safe to administer nitrous oxide alone. It is surely sufficient merely to call attention to the enormous difference it makes to the patient, which of these anæsthetics is used.

To resume, the root, having been removed from the mouth, should be wiped off the blades on to the towel tucked round the patient's neck. It is a filthy practice to throw the teeth about the room, and besides it may be of the greatest value to have the root available for rapid examination, as already explained.

For this latter reason too, it is a mistake to drop the roots out of sight into a spittoon, as some do, excellent though the practice is in some respects. In this connection may I be allowed to plead for more interest on the part of the average dental surgeon in the teeth and roots which he extracts. Quite apart from what may be at present of purely scientific interest, he might learn a great

deal that would be of great practical value to him. For instance, how many dentists having extracted a molar with an amalgam filling in it, carefully examine it to determine, if possible, the factors that have led to its lasting perhaps ten or twenty years, or on the other hand, why a filling inserted with all the care and skill of which the operator was capable has not been effective even for a couple of years? I cannot help thinking that some of us would be doing better service to our patients, if we incorporated in our work the lessons to be learnt from a post-mortem on teeth that have had to be removed. Apart from this directly utilitarian aspect, how many valuable specimens are thoughtlessly thrown away that would be prized in a private or public museum, and that would help to elucidate some of the unsolved problems of dental pathology!

CHAPTER VI

THE USE OF THE ELEVATOR

ALTHOUGH most extractions are best performed with forceps, there are cases in which other instruments are more suitable, and of these the most frequently used is the elevator. The pattern that I have been using for some time, after trying most of those that have been put on the market, is shown in the illustration (fig. 40). The others have been rejected for faults in the handle or in the length, angle, or shape of the blade. My own has passed through many modifications, and as put on the market, the blade is on the long side; but as the edge must be kept keenly sharp, it tends in the course of time to become too short. Many operators pin their faith to the straight elevator, just as the majority of dentists pin their faith to a multitude of forceps of all sizes, shapes, and weights, varying from "straights" to those, the conformation of which might excite the envy of a contortionist snake.

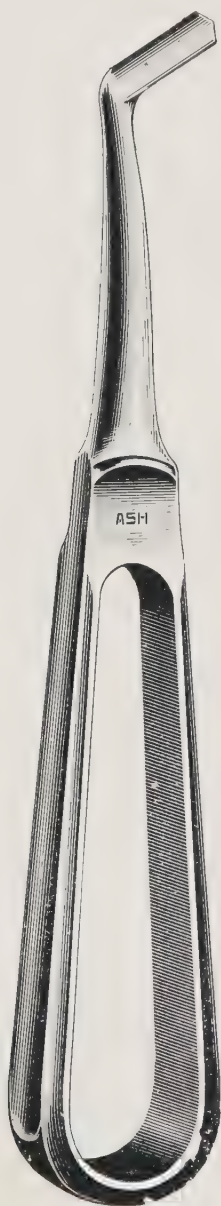


FIG. 40
Elevator

It is of course *possible* to remove all or any of the teeth with elevators; but they are only used as a rule in removing mandibular molars, especially when these are reduced to buried roots. In a well-known text-book, the statement occurs in black print, "The third molar is best removed with a straight elevator." Of course third molars can be extracted with a straight elevator; but there are many failures, and considerable damage has frequently been done to the bone and to the second molar. For routine work the third molar is best removed with forceps, and an elevator of any kind is an unsuitable instrument, whilst the "straight" one is the most unsuitable that could be conceived.

It is usually recommended that elevators should be used from before backwards. Personally I very much prefer, when there is any option, to use them in the reverse way—from behind forwards, and for several reasons. The first

is that thereby the surgical principle is fulfilled of cutting away from the danger zone. The parts that an elevator might damage by slipping are more important at the back than further forwards in the oral cavity. Secondly, the tongue and cheek and maxillary arch converge upon the mandibular teeth distally, and one has more freeway by getting the instrument at the outset as far back as it is to go and then working forward into a less restricted zone. Thirdly, by working from behind forwards, the roots are pushed in the direction in which one wishes them to go, that is, towards the lips; and fourthly, if the conduct of the left hand be such as is advised later on, it is easier to catch the displaced root between the forefinger and thumb or to guide it out of the mouth with the forefinger, when the instrument is distal to the root. Fifthly, the act of supination is more powerful than that of pronation and this advantage is gained upon the patient's left side, though it is not on the right for a "one-handed" operator.



FIG. 41

Mandibular molar with roots curved distally and the blade of an elevator applied mesially and distally.

In recommending the use of the elevator from before backwards, stress is laid by some authors on the fact that mandibular molar roots, especially of the third and second molars, are curved backwards. This is true of a number, but not of the great majority, and of those that *are* curved backwards, in only one out of a thousand does the amount of curvature warrant the prominence that has been given to it as a factor in extractions, whether with forceps or elevator. Even in cases where there is considerable distal curvature of the roots, one finds clinically that they are on an average as easily dislodged, using the instrument from behind forwards as in the reverse way. From a purely mechanical standpoint, it is difficult to see how any advantage lies in applying the point of the elevator to the convex instead of to the concave surface of the root—on the contrary it should bite more firmly and therefore dislodge the root more readily, if applied to its concave surface (fig 41). Whilst urging the routine use of the elevator from behind forwards, one must be reasonable, and no operator would be so foolish as not to try the effect of using the instrument from before backwards, if no success has attended his efforts in the other direction.

Technique. The text-books usually advocate that the handle of the instrument shall be firmly grasped in the right hand and the forefinger extended along the shaft, so that its tip is near the point. Whilst this is the best and safest way of using the straight elevator, it is not the most efficient way of holding the curved

elevator. The object of thus holding the instrument is to act as a stop and guard in case of its slipping, which it is very apt to do.

The instrument should be firmly grasped in the hand, as shown in the photograph (fig. 42), and the patient protected from avoidable injury by the operator's always making a point of having the forefinger and thumb of his left hand intervening between the blade of the instrument and the tongue, cheek, etc., which might be injured by any slip. There is nothing more likely to make an operator keep his elevator under control than the certainty that its sharp point must first cause injury to

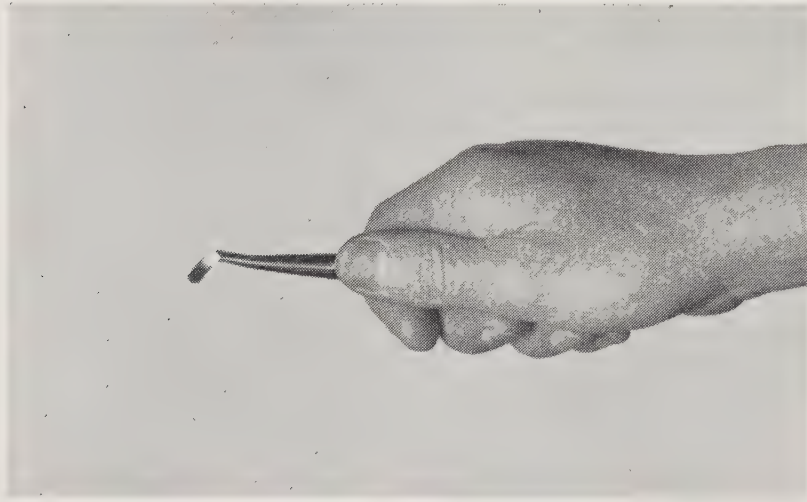


FIG. 42

Method of holding the angled elevator.

himself before injuring his patient. The conduct of the left hand then is very important and is exactly the same as in the extraction of roots with forceps. The *alveolus* is firmly grasped between the left fore-

finger and thumb and the remaining fingers support the mandible from below. The point of the elevator is then applied to the distal (or mesial) aspect of the root to be removed and forced into the socket, a slight rocking motion being given to it, if there is any marked resistance. The mere driving of the blade into the socket will dislodge many roots; but it is usually necessary, after the blade has been driven well in, to rotate the handle steadily so that the sharp point bites into the root and prises it out of its socket.

It will be noticed that when applying the point of the blade to the gum, the operator's elbow is raised high into the air, in order to get the blade in line with the root, and that as the blade sinks in, the elbow descends. During and at the end of rotation, the handle may be so depressed that the point is actually directed upwards. In order, however, not to damage the external alveolar plate by making it a fulcrum, it is advisable not to depress the handle below the horizontal, and to depend more upon the rotation of the handle for the dislodgment of the

tooth than upon using the whole instrument as a lever of the first order. If this advice is followed, the blade is simply driven into the depth of the socket, and consequently there is very little risk of the operator's left digits being damaged; for the point, having reached its lowest level in the socket, should practically only *move in the arc of a circle*, the radius of which is represented by the length of the blade. If, however, the operator actively pushes the point onwards with a scooping motion after it has reached its lowest position, then, should the root be dislodged with unexpected ease or the blade slip off it, owing to its not biting on account of bluntness, injury may be done by the uncontrolled instrument. The root having been dislodged, it is caught by the left forefinger and thumb, or guided out of the mouth by the finger and thumb on each side of the blade.

As a general rule, the elevator should never be used where the operation can be performed with forceps. This is particularly the case where the patient's sensibility to pain has not been in any way dulled, as an elevator usually inflicts more pain than forceps. Again, an elevator usually damages the bone more than forceps, and the injury also being inflicted deeper down in the socket, there is more chance of post-operative pain and of slower healing of the wound.

Another general rule is that the elevator should not be used to dislodge maxillary roots. The reason is that they can almost invariably be more easily extracted with forceps. Again, in the region of the maxillary sinus there is more risk, when the elevator is used, of the sinus being damaged or of a root being forced into it. Moreover, attempts to remove the third molar with the elevator have frequently led to considerable damage to the surrounding parts. The maxillary tuberosity has been levered off with the tooth, the fracture often involving the posterior wall of the maxillary sinus and in some cases the adjoining portions of the palate and sphenoid bones, the laceration subsequently leading to cicatrization and impairment of function. There are cases, however, to be indicated later on, where the elevator is the best instrument for the removal of a maxillary root.

The most common use for the elevator then is in the extraction of mandibular molar roots. It is rarely employed in the case of the front teeth and premolars; for these, owing to the shape of the root and the nature of the surrounding alveolus, can almost invariably be more easily removed with forceps. In the case of molar roots and "impacted" third molars, it is very often a great convenience and at times indispensable.

As has already been stated, forceps should be used wherever possible, and where the elevator is indicated, it is better to remove the root most easily accessible to the forceps with them, and

then to introduce the blade of the elevator into the vacant socket to dislodge the neighbouring roots. The cases where an elevator is indicated are those where caries has progressed to such a degree as to involve the root, so that it has become more or less buried under the gum. Many such cases are still amenable to carefully applied forceps; but in some, considerable damage would be done to soft parts, whilst it might be necessary to drive the forceps in a considerable distance beyond the decalcified portion, to obtain an efficient grasp of the root. Such roots are usually considerably modified in shape and size as a result of chronic pericementitis, there being most commonly a rarefaction of the root, but occasionally a cemental hyperplasia. In either case, there is associated some degree of rarefying osteitis, which may progress to a complete removal of the septa between the roots and to their replacement by fibrous tissue. Consequently, one root having been removed, the sharp point of the elevator usually passes easily through the septum to engage the side of the neighbouring root.

The elevator is also indicated for the removal of a root which has been fractured below the level of the alveolar border in the course of extraction with forceps. Such an accident most frequently occurs in the case of a tooth that has been isolated for some years owing to previous extraction of its neighbours. Around such a tooth the alveolus tends to become dense and unyielding, whilst the roots themselves may be thickened by cemental hyperplasia and the whole tooth be more brittle than normal on account of senile changes or of operations on the root canals. It is always a relief when such a tooth—often a second molar—is extracted whole, but there are cases where, in spite of every care, one root (usually the distal) or both fracture across, just within the socket. The treatment of fractures will be dealt with in another chapter, and all that it is necessary to say here is that if one root has been extracted with forceps, the remaining one if fractured within the socket can usually be dislodged most readily and with least damage with the elevator, introduced into the vacant socket. Another use for the elevator is in the extraction of misplaced teeth, especially impacted third molars. Its use in this connection, and also in the removal of necrosed milk teeth, will be dealt with in subsequent chapters.

CHAPTER VII

DIFFICULT EXTRACTIONS

THE great bulk of teeth requiring extraction present no special difficulty, provided the principles already laid down be followed. One occasionally, however, meets with cases requiring special consideration which may tax the skill of the operator to the uttermost, may necessitate considerable injury and suffering to the patient, and may in fact border upon a serious operation. Fortunately, the number of these cases that occur in any one practice is small, and even in an extensive practice one may not occur for years. The difficulty may lie in many factors such as the shape and size of the tooth, its position in the mouth, and relationship to other parts such as the nasal fossa and maxillary sinus; or the occurrence of gemination, cemental hyperplasia, ankylosis, odontomes; also of inflammation and suppuration, with possibly considerable swelling of the surrounding parts and inability to separate the jaws, etc.

Where abnormal features present, the case must be carefully studied, before any operation is performed. Thus, if pain of obscure origin has been complained of, one must not too hastily attach blame to a malposed tooth, for instance, simply because it is malposed. Again, such questions as the age, temperament, and physique of the patient and the choice of a suitable anæsthetic must be considered. A skiagram is often a valuable aid not only in diagnosis, but in deciding upon the nature of the operation and the manner of its performance. For instance, in the case of an impacted third molar, the operator learns from it the position in which the tooth is lying, the characters and number of the roots, the presence or absence of rarefaction of the tooth or of its neighbour, the depth at which it is buried in the bone, the changes that may have occurred in the surrounding bone as a result of inflammatory processes, and the thickness of bone between the aberrant tooth and the lower border of the mandible. With the aid of such a skiagram he can operate with the feeling of confidence that comes of accurate knowledge, and the chances of a rapid and successful result are greater in proportion.

Difficult and abnormal cases for extraction are much less often met with in the maxilla than in the mandible. The teeth are rarely in sufficiently abnormal positions to cause extreme

difficulties. **The canines** are the most frequently malposed to such an extent as to need special treatment. They sometimes erupt into the palate, but much more frequently high up on the facial side of the alveolus. However much one may regret it, it is necessary in a certain class of practice to extract such a tooth in order to treat the malocclusion, and it is also sometimes necessary in good-class private practice, if the ill-health of the patient precludes more rational treatment.

In extracting these teeth, the lip should be raised, and the blades of the forceps applied to the mesial and distal surfaces of the tooth, not in the direction of its long axis, but almost at right angles to it, as is shown in the photograph. The operator then forces the blades into the alveolus, grasps the tooth firmly, and whilst still pressing makes short, rapid, to-and-fro movements, causing the tooth to make corresponding rotations on its long axis, so that it becomes loosened and can be removed. The whole secret of the easy extraction of these teeth lies in keeping the forceps almost at right angles to the long axis of the tooth—there is then no tendency for them to slip up the surface of the alveolus, and one can usually get a very efficient grasp of the crown over the mesial and distal angles. In difficult cases, such as where the tooth is only partially erupted, it is a great advantage whilst retaining the ordinary grasp of the forceps, to pronate the forearm so that the concave curve of the handles is uppermost. This allows the blades to be properly applied without the operator's having to elevate his elbow to such an extent as would otherwise be necessary, and there is thus practically no chance of the blades slipping up the alveolus (fig. 43). On no account must the operator fracture such a tooth, lest a comparatively simple case becomes a difficult and painful one.

The following is an illustrative case:—Patient, aged about thirty, had a right malposed maxillary canine fractured at sixteen. He suffered greatly for some time, probably owing to the pulp being exposed in the fracture. Eventually an apical abscess formed, with recurrent swelling and pain for several years. During the year previous to my seeing him the swellings became more frequent, with great discomfort and tenderness over the right maxillary sinus. Examination showed the right second premolar and first molar to be missing. The first premolar was ranged alongside the lateral incisor, and there was considerable recession of the gum on its distal aspect. High up in the alveolus was a sinus leading to the buried root. Ether was administered, the patient sitting upright in the dental chair. When he was fully anæsthetised, a sponge was placed in the right cheek and another forced between the upper and lower front teeth, the object being to absorb all blood. A horizontal incision, passing through the orifice of the sinus, was made down to the bone. A rapid examination was made with a sharp probe, and it being obvious that forceps were useless, the blade of an elevator was passed between the apices of the roots of the lateral incisor and premolar, which were distinctly divergent, and an attempt made to force the instrument under the canine. Great care having to be exercised owing to the proximity of the maxillary

sinus and nasal fossa, slow progress was made with the worming movement of the elevator, and it soon became obvious that the premolar was becoming loosened by the leverage on its root. Efforts were made to support it, but a few minutes later it shot out of its socket. There was now more room for operating, and after gouging away the bone on the alveolar side, the root was turned out with the elevator. The operation lasted nearly five minutes, and upon recovery the patient complained of severe pain, which subsided in the course of an hour. An excellent recovery followed, although there was some swelling and a good deal of pain for a week.



FIG. 43

Illustrates method of extraction of a maxillary canine, which has erupted on the facial aspect of the arch. The thumb is placed on the cutting edges of the teeth, and the forefinger lifts the upper lip to expose the crown freely. The forceps are held in the right hand as usual, but they are applied to the tooth with the forearm pronated, so as more easily to apply the blades almost at right angles to the direction of the crown. The tooth is firmly grasped, made to rotate on its long axis, and removed.

I have had other somewhat similar experiences, and the difficulty there is in safely removing the apical half of the root, as in the case detailed above, indicates the necessity there is for the dentist to relinquish his efforts at removal, before fracturing the tooth.

A maxillary canine may fail to erupt at the normal time, and may subsequently become exposed by the absorption that follows the extraction of the rest of the teeth in the maxilla. In such

cases the crown nearly always presents in a direction downwards and towards the mesial line, the tooth lying almost parallel to the alveolar margin. It may also lie in the palate almost horizontally, with the crown forwards. In either case a free incision should be made over the crown, reaching down to the tooth. When the exact direction in which it is lying is not certain, it should be determined as far as possible by means of a sharp steel probe or a skiagram. The crown should then be grasped by forceps, and by firm yet careful rotation of the tooth in its long axis it should be loosened and removed. The great majority of these teeth have straight roots; but those erupting in facial occlusion are frequently curved at the apex, sometimes quite sharply, and yet fracture is very uncommon.

Canines very rarely erupt into the nasal fossæ, and then they lie horizontally covered by mucous membrane, with the crown forwards. I have met with only one case, and it was easily removed with forceps introduced into the nostril.

After operations for cleft palate, in which the *os incisivum* has been reflected, a lateral incisor may erupt into the nasal fossa. I have met with two cases, and the teeth were easily removed with forceps through the very patent nostril.

The first premolar is very seldom sufficiently malposed to require special treatment; but the **second premolar** may be in partial or complete lingual occlusion, and it may be deemed wise to extract it. If there is sufficient space between the first premolar and first molar to admit the narrow blade of a pair of forceps, the extraction can be performed on ordinary principles. It is, however, when there is no space whatever that extraction is more likely to be called for, and then the tooth should be grasped by forceps applied to the mesial and distal surfaces, and whilst the blades are firmly pressed upwards, slight lateral and rotatory movements should be performed, until it is loosened. These teeth are also often in torso-occlusion, so that the facial surface presents towards the incisors—they should then be grasped by their facial and lingual surfaces in the ordinary way.

The maxillary molars rarely present marked malposition. I have, however, met with four cases of unerupted or truly impacted third molars, two of which presented difficulty in their removal. They will be considered in another section.

In the mandible **the incisors** may be very crowded, and if it is considered wise to extract one, forceps with a narrow blade, 74N. (fig. 4), which can be passed into the space between the adjacent teeth, should be used. If the tooth is in facial occlusion, it should be extracted on general principles. If it is in lingual occlusion, it must be tilted lingually by raising the handles of

the forceps. An incisor considerably out of the arch, whether facially or lingually, may, however, be quite easily extracted with the ordinary pattern of forceps, by a manoeuvre somewhat similar to that used in the removal of maxillary canines in facial occlusion. The blades are applied not in the long axis of the tooth (for in that case they are apt to slip when pressure is applied), but almost at right angles. They are firmly driven in, the tooth firmly grasped and gentle rotatory movements imparted to it, until it is loosened (fig. 44).

Mandibular canines, when malplaced, are practically always in facial occlusion. Should their removal be decided upon, it can

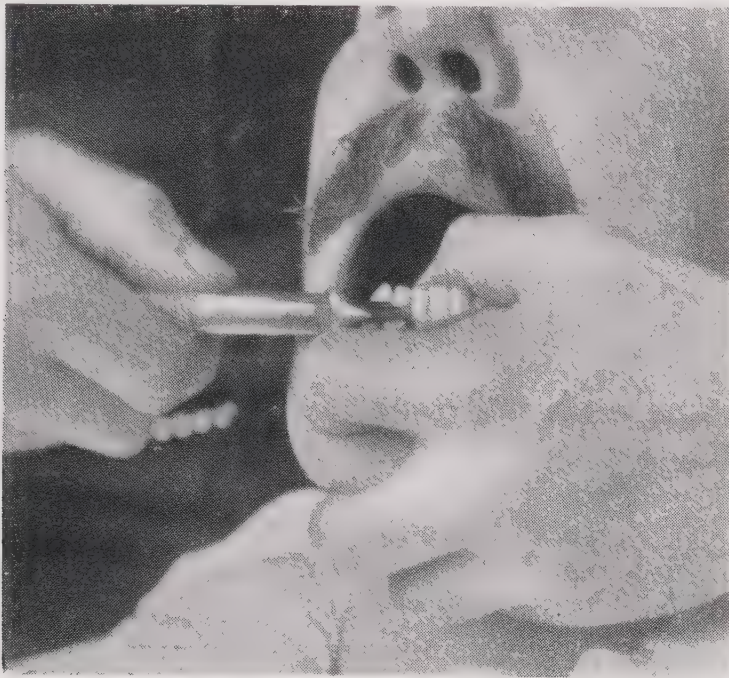


FIG. 44

To illustrate extraction of mandibular canine or incisor in complete facial occlusion—in this case a central incisor.

be readily performed by using the ordinary forceps in the manner just described for incisors. I have met with several cases (all in hospital practice) in which this tooth has been lying in an almost horizontal position, the crown presenting towards the lip and the premolar almost or completely in contact with the lateral incisor. In one extreme case, the crown of the right canine had passed below the level of the buccal sulcus into the lip and could be easily detected through the skin. Deep palpation on the lingual aspect of the mandible enabled one to detect the apex of the root under the mucous membrane. An incision was made at the bottom of the buccal sulcus, parallel to the bone, and the lip being everted, the crown was brought into view. It was firmly grasped sideways with "upper" forceps, made

to rotate backwards and forwards on its long axis and then drawn upwards and removed. During the operation, the finger in the floor of the mouth easily detected the movements of the root.

The first premolar very rarely calls for special treatment, though I have met with two cases closely simulating the one just described. In both cases the crowns were just presenting in the buccal sulcus, and the teeth were removed by an operation similar to that described above, except that one of them, which had scarcely erupted through the bone, was removed by an elevator driven in underneath it.

The malposition of **the second premolar** is almost always lingual, and the tooth then generally has a large curvature in the linguo-facial plane. As in the case of other malposed teeth, its extraction, judging from the text-books, is a matter of great difficulty. The author has extracted a relatively large number without any difficulty at all, with ordinary lower forceps. The blades are applied to the mesial and distal surfaces of the tooth and as horizontally as the incisor teeth will allow. They are driven firmly into the tissues, and whilst the pressure is maintained, the crown is grasped and the handles alternately raised and lowered, so as to impart rotation to the tooth (fig. 45). It usually loosens quite readily and is then removed. Should there be sufficient space between the first premolar and molar, narrow-bladed forceps may be used, as in the case of maxillary premolars.

The extraction of **supernumerary teeth** is usually a simple matter, any difficulty that may arise being due to their close proximity to neighbouring teeth. The crown varies much in size, but the root is almost invariably single, conical, and short rather than long. Their commonest sites are in the maxilla between or lingual to the incisors, and on the facial side of the molars, especially between the second and third. They are extracted with forceps applied in any way that the neighbouring teeth will allow of. They are firmly grasped and rotated in their long axis and so removed.

It must be remembered that a supernumerary tooth is frequently united to a neighbouring tooth, and that the union may involve only the root or a small part of the root, and that the crowns may be an appreciable distance apart. In such cases, which are fortunately uncommon, the supernumerary tooth will fracture somewhere, unless the attachment to the surrounding tissues is so feeble as to permit of both teeth being extracted together.

No special directions are needed for the extraction of teeth that are **geminated**. It should be remembered, however, that although the two crowns may be completely fused, there may be

separate roots and this may prevent the appropriate movement being imparted to the tooth. Thus it may prevent rotation of a maxillary central incisor, which will then require to be extracted by being carried facially. A tooth geminated to a molar is removed by the movements appropriate to the molar to which it is united.

Dilaceration. As a result of injury to a developing tooth, the formed part may be dislocated on the tooth germ, so that the part subsequently calcified forms an angle with the part calcified



FIG. 45

Extraction of right mandibular second premolar, which is in complete lingual occlusion.

prior to the dislocation. Any teeth may be thus affected, but especially the maxillary central incisors, which tend not to erupt, but the incisive edge forms a prominence under the gum, high up on the facial side of the alveolus. The gum must be incised the full length of the incisive edge, if necessary, and forceps applied to the mesial and distal aspects of the tooth. Whilst the blades are driven firmly into the bone, the tooth is gently rotated to loosen it; but this movement must be desisted from, if any undue resistance is met with. Then the handles should be rotated upwards towards the patient's forehead, so that the tooth can be delivered in the direction of its curvature. In most

cases I have met with, the angle formed occurs near the neck and is very pronounced ; but in some the angularity is trifling, although the incisive edge is presenting facially. A skiagram is of value in indicating the position and angularity of the root.

A similar condition is sometimes found in the mandibular premolars, though usually of the nature of a telescoping or impaction, due to an inflammatory affection of the roots of their milk predecessors. The premolars are extracted in the ordinary way—in fact, the pathological condition is often not detected until after the tooth has been extracted.

Impacted third mandibular molars undoubtedly present far greater difficulty in extraction than any other teeth. By impaction is meant the non-eruption or partial eruption of the tooth, and not necessarily that it is confined and, as it were, under pressure between the base of the coronoid process and the second molar. It is true that these conditions are usually present ; but some of the most difficult and serious cases I have operated on have been edentulous, at least as far as the molars are concerned.

Altogether I have operated on about sixty cases during the last ten years, and at the risk of straying somewhat from the title of this book, it may be of interest to record some observations, especially as they have direct bearing upon practice. All the cases occurred in private practice, the patients belonging chiefly to the upper middle class—not one case occurred in the class from which hospital patients are drawn. The great majority of the patients were women, between the ages of twenty and thirty. Three of the women were between forty-five and fifty, and two of these were otherwise edentulous and had been so for many years. Of the males about half the number were between forty and fifty. In one case that was referred to me by Mr Girdwood, the patient was a healthy man of seventy-one years, who had retained practically all his teeth. There was some discomfort in his right mandibular teeth, for which there was no obvious cause. It was noticed that the third molar was absent, so a skiagram was obtained, which revealed the tooth lying horizontally with its crown against the root of the second molar. Owing to the mildness of the symptoms, the age of the patient, the absence of any sinus and consequently the remote chance of infection, the case was not operated on.

As will be seen from the photographs of some of the specimens, there is on the whole a distinct family likeness (fig. 46). Nearly all, fortunately, present a single massive root, with usually only a slight indication of any tendency to the formation of two roots. Varying degrees of cemental hyperplasia are present. In only one of my cases was there pronounced rarefaction, and it was on

the lingual surface, at the junction of the apical and middle thirds. The pulp canal was widely opened into and the pulp was gangrenous—there had been several subacute inflammatory attacks with neuralgia for three months previous to operation. In one case there was gemination to a molariform, supernumerary tooth.

The onset of symptoms is insidious, becoming pronounced in the course of months or years. The operation at best is apt to be a severe one, and experience teaches plainly that as soon as symptoms begin to show themselves, the patient should be advised

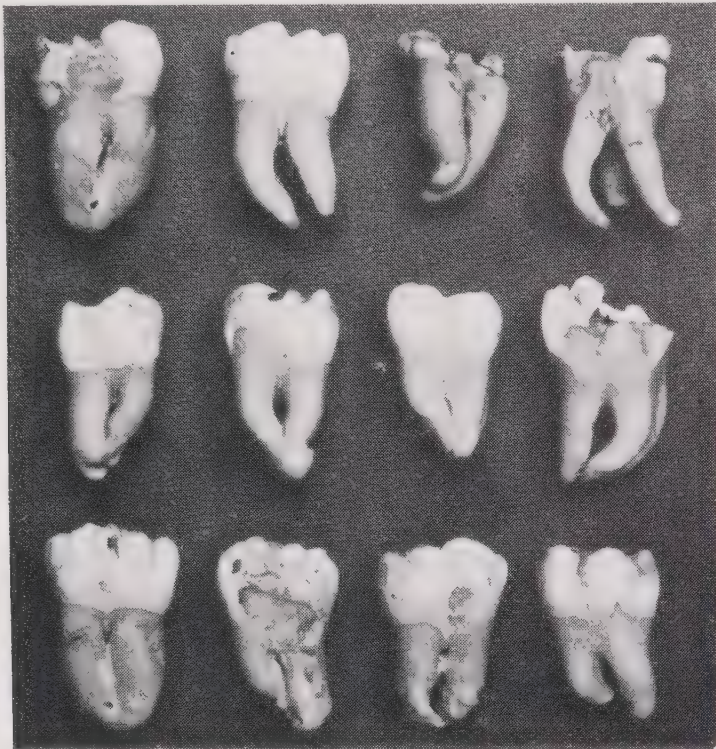


FIG. 46

A series of impacted third molars. The damage that has been done to the crowns in extracting them is plainly seen.

to have the tooth out. On no account should the case be allowed to progress to infection and abscess formation. The post-operative sequelæ are not nearly so severe, when there is no previous infection. When infection has already occurred and there is chronic suppuration, the tooth should be removed during a quiescent period instead of waiting for some acute attack which is inevitable, and during which it will probably be compulsory to operate, to the great disadvantage of all concerned, particularly of the patient. In urging that the tooth should be removed before infection takes place, it is not only wise but a duty frankly to explain to the patient the possible immediate after-effects of

the operation. As the great majority of extractions entail practically no untoward after-effects, patients are only too apt to blame the operator, when they do arise. In the case of an impacted third molar, it should be made clear that the operation is a much more severe one than the extraction of an ordinary tooth. This is particularly the case where sepsis has already supervened. Patients, however, react very differently to the operation. In some of my cases there were severe after-effects, although they were not expected on account of the comparative ease of the operation, absence of excessive damage to surrounding parts, and of sepsis at the time of operating; whereas in other cases where great difficulty had been met with and considerable damage done, the patient experienced very little discomfort. Consequently, the patient should be warned, not that after-trouble is a certainty, but that it is a distinct possibility, and unless the operation is an urgent one, a time should be chosen when he can best afford to lay up for a week, if necessary.

An operation having been decided upon, the patient should have the mouth put into as clean a condition as possible and especially if there is infection, the teeth should be carefully brushed and antiseptic mouthwashes, preferably peroxide of hydrogen, used for some days. He is then prepared as for a surgical operation in the manner already described. I have twice at the patient's urgent request operated under local anæsthesia, there being no antecedent infection. The patient, however, needs to have a good deal of pluck, and a general anæsthetic is greatly to be preferred. The operation may take from one to thirty minutes or more, and so ether should be chosen, preceded by nitrous oxide or ethyl chloride, with the patient sitting upright in the dental chair.

If there is an impaction on each side of the mouth, only one tooth should be operated on at a time, unless the first one is dislodged easily and with practically no damage to surrounding parts. The reason is that there is apt to be so much swelling, pain, and dysphagia for some days after the operation, even when performed on one side only, that it is not safe or justifiable to operate on both. The tooth, causing or likely to cause the greater disturbance, should be operated on first and the other one two or three weeks later.

As for the operation itself, it is difficult to lay down any hard and fast rules, and only general principles for guidance can be indicated. Should the tooth be completely hidden by gum, with perhaps only a sinus leading to it, an antero-posterior incision should first be made down to tooth or bone, if anything to the facial rather than the lingual side—this ensures less laceration of soft parts. If a skiagram has not been taken, a sharp-pointed

probe or an elevator can now be passed into the wound, and the operator can as a rule readily gauge the extent to which the tooth is covered with bone, and also the direction in which it is lying. The tooth may occupy any position between the vertical and horizontal, and in the latter case the crown is towards the second molar. It may also be somewhat rotated on its long axis, so that the mesial surface is directed lingually, and it may be tilted in the same direction ; but generally the only tilt is a purely forward one.

Contrary to conventional teaching, forceps are much to be preferred for the removal of these teeth. The mouth should be widely opened, the left forefinger and thumb passed to the back of the second molar and the lower forceps applied to the part of the tooth that is presenting, usually the distal cusps. Care must be taken that the mucous membrane of the cheek is not included in the grip of the forceps. The tooth having been grasped, the forceps should be driven into the tissues with all the force of which the hand holding them is capable, whilst the left forefinger and thumb must on no account be removed from their position in order to help by pressing with one of them on the back of the forceps. At the same time that downward pressure is made, the handles of the forceps are depressed and every effort made to prevent the lingual blade from slipping off the tooth. In a difficult case, however, this will happen many times and the forceps must be reapplied over and over again. On no account must the operator snap off the crown, as thereby the difficulties will be enormously increased. If the forceps are used intelligently, the tooth will usually soon be loosened, especially if it is lying nearly horizontally, for it rotates on its long axis. There may be considerable difficulty in dislodging the tooth, even after it has been loosened, mainly through its being overlain by the distal surface of the second molar, but also in many cases owing to the dense bone lying over its root. The tooth having been loosened with forceps, it may be possible to complete the operation with them, but an elevator is often more serviceable. A sharp elevator can be used to gouge off some of the bone overlying the root, but this is usually unnecessary. It is a good plan to work an elevator in under the tooth (from before backwards and from the facial side), without making any very special attempt thereby to dislodge it, and taking special care not to injure the second molar. It can then usually be readily delivered by the following manœuvre, especially if it is lying more or less horizontally. The forefinger, if the impaction is on the patient's left side, or thumb, if it is on the patient's right, is placed on the lingual aspect of the loosened tooth, to safeguard the patient and to make the operator cautious. The sharp point of the elevator is now applied to the facial aspect of the neck of the tooth, and

by applying pressure, the crown is forced through to the lingual side from under the overlying second molar and is hooked forwards by the thumb or forefinger, as the case may be. When the tooth is in a somewhat vertical position, forceps are usually more efficacious and do less damage than the elevator. If very little progress is being made, however, a sharp elevator used from behind forwards to break down the bone on the distal and disto-facial side of the socket is a great help. No attempt should be made to force an elevator between the two teeth, as this and the subsequent leverage applied are apt to damage the distal root of the second molar. The damage, thus occasioned, necessitated the subsequent extraction of the tooth in one case; whilst in another, the tooth was extremely sensitive to changes of temperature for more than a year.

There is another method of dealing with these cases which appeals to many dental surgeons, namely, extracting the second molar and leaving the real offender alone. It may be the best procedure for one who does but little extracting and so cannot be expert, if circumstances prevent his sending the patient to a specialist. It is quite true that, in some cases, the extraction of the second molar mitigates or relieves the symptoms produced by the condition of the third molar; but there are many objections to the practice. In the first place the patient loses what is probably a good and fully functioning tooth, and the third molar, even if it completely erupts, usually does so in a position that renders it functionless. Secondly, extraction of the second molar does not usually relieve the symptoms sufficiently to render the patient comfortable, and in many cases does not relieve at all. It is often urged that the extraction of the second molar, as a preliminary to the removal of the third, facilitates the operation, but it is not right to deprive the patient of a useful tooth unnecessarily. In all my cases in which it was present at the time of the operation, it was not removed, with one exception. In that case the patient was a man about twenty-two, with the third molar in a vertical position. He had suffered greatly from neuralgia, and for some weeks from suppuration, and the tooth could be felt with a probe under the inflamed gum. The bone was very dense and it was impossible to get sufficient grip to loosen the tooth. The bone was consequently gouged away from over the distal part of the tooth and from the facial side, and in the course of doing so, the distal root of the second molar became not only denuded of bone, but itself damaged. In spite of all the force I dared use, the tooth appeared to be as firm as ever at the end of twenty minutes, and taking into consideration the damage already done to the second molar, I decided to extract it, and this having been done, the third molar was dislodged by forcing

the elevator between the bone and the distal side of the tooth, thus wedging it forward into the empty socket of the second molar.

The after-treatment is all-important, as will be seen from some of the cases described later. Immediately the operation is finished, the patient should be put to bed, lying so that the side operated on is uppermost. This position tends to better drainage, lessens congestion and œdema, and when the patient fully recovers from the anæsthetic, diminishes pain by avoiding pressure on the part. The patient should be kept warm, the room well ventilated but without draughts, and the blinds drawn sufficiently to shade the room. Sleep should be encouraged, as the patient will wake up quite soon enough.

It has already been pointed out how variable is the amount of pain following this operation ; but in any case the patient usually gets through the first night fairly comfortably. Owing to the proximity of the wound to the fauces and the damage to the neighbouring soft parts, there is usually some dysphagia, which clears up in two or three days. It is on the second and succeeding days that the pain is apt to be severe, and to ensure a good night's sleep, a hot drink of milk or beef-tea should be ordered, followed if necessary by twenty grains of sulphonal or even one-twelfth or one-sixth of a grain of heroin. This may have to be repeated for two or three nights. During the day the patient should frequently rinse out the mouth with a hot solution of phenol sodique, which is a good anodyne, or with peroxide of hydrogen, diluted with three times its bulk of hot water. *The dentist himself* must every day for the first few days carefully syringe out the socket right to the bottom with the same warm lotion, and at the same time make sure that the swollen tissues are not damming up the discharge. I have tried packing the wound lightly with gauze, but in each case the pain has seemed to be aggravated. When it is necessary, a friend of the patient can be taught to syringe out the socket ; but for the first few days and until it is obvious that there is no longer any danger from sepsis, the dentist should himself be responsible for its being thoroughly done. Care must be taken that *the mouth is opened to its full extent every day*. If this is not done, it will soon be impossible to do so, whilst in the course of a few weeks the patient may be only able slightly to separate the teeth, and then has to undergo the painful process of having the adhesions stretched and broken down. Should he be unwilling to open the mouth widely on account of self-inflicted pain, the dentist must hook the fore- and middle finger of one hand over the maxillary teeth and those of the other hand over the mandibular teeth and exert gentle but forcible traction in opposite directions.

Should there be dysphagia, the diet will have to consist of such

food as milk, custard, eggs and soup. The bowels should be moved every day as this will help to relieve pain and to promote healing.

It is usual for small sequestra to come away during the process of healing by granulation. It is seldom that the patient has any discomfort from the operation after ten to fourteen days ; but the wound may take many weeks or months to heal completely, and in one case there were still a few granulations, at the bottom of which bone could be felt, eighteen months after the operation.

Some unfortunate experiences were met with in the following series of cases, and they have such an educational value that no excuse is necessary for narrating them here.

1. An English dental student was sent to me to have the left third molar removed. There had been suppuration around it for some months. When seen, the jaws could be fully separated, and pus could be readily expressed by pressure around the tooth. Ether was administered and the tooth removed without any exceptional difficulty.

The patient was given full instructions, which a medical friend undertook to see carried out. I learnt a few days later that these instructions were not being carried out, and I again urged the necessity for it. Six weeks later, I learnt that the patient had been in bed for more than three weeks suffering from sapræmia, and that his condition was attributed to my having used dirty instruments ! To cut a long story short, it was at last admitted that considering the extent of sepsis already present at the time of the operation and the subsequent disregard of instructions, it was not necessary to assume that I had been guilty of such an outrage.

Case 2. A dentist. Both third molars were impacted and both were erupted to the extent of having a distal cusp through the gum. There had been some neuralgia and local discomfort, but there was no evidence of infection. The right molar was extracted under ether and the patient syringed out the wound daily. When seen a week later, the wound looked so well that I operated on the other side. The patient came to see me eight days later with the left side of the face and neck enormously swollen, unable to open the mouth, and looking and feeling ill. He said that there had been some difficulty in finding the hole in the gum (through which the tooth had apparently been removed by the stretching rather than by the laceration of the tissues), and that he had been unwilling to trouble me until driven to it. Examination revealed a red area below the angle of the mandible, and fluctuation was easily obtained. The mucous membrane presented a greyish appearance, and there were two whitish spots an inch apart, where pus was pointing, and in addition pus was lying in the almost obliterated buccal sulcus. Nitrous oxide was administered with the maximum of air, and a two-inch incision made through the mucous membrane forwards from the socket of the third molar. A large egg-shaped necrotic mass was extruded into the wound and removed, and there was a free flow of pus. A closed pair of artery forceps was passed through the incision into the abscess in the neck, which was thereby evacuated. The patient having recovered consciousness, the abscesses were thoroughly syringed out. A large rubber drainage tube was passed into the abscess in the neck, and the incision packed with bichloride gauze. The wound was dressed daily for ten days and matters were markedly improving, when it became obvious that another abscess was forming behind the angle. Nitrous oxide was again administered and the abscess opened into the old wound. Drainage was effected by bending a narrow piece of rubber tubing upon itself and passing the loop into the abscess. No further difficulties were experienced, and everything had healed in seven weeks from the date of the first incision.

These two cases occurred early in my experience and at a very short interval of time. I had already learnt the necessity for thorough syringing during the healing process ; but it was these cases that taught me that the patient must remain under personal supervision.

Case 3. A man about forty had a copious discharge of pus around the right third molar, the distal cusps of which were presenting through the gum. Ether was administered and the tooth removed with difficulty. As I was unable through illness to carry on the after-treatment, full instructions were given to those in charge, but in spite of every care, an abscess (the beginnings of which were present, I think, at the time of the operation) formed in the cheek. It was opened into the mouth and everything healed up well.

Case 4. Lady about forty-five, who had been in the East and suffered from malaria. For many years she had been subject to severe left-sided trifacial neuralgia, and eventually it was discovered that the third molar could be detected with a probe close behind the neck of the second molar. It was my first anæsthetic case with the dentist in question, and upon my arrival he told me the nature of the case ; but made no mention of my operating. When the patient was etherised, he asked me to operate, and I foolishly consented. Having examined the parts, I made an attempt with forceps ; but as it was impossible to get hold of the tooth, I took an elevator and was working it down on the mesio-facial side of the tooth, when I suddenly felt the bone fracture through the socket of the third molar, which was then easily removed. The tooth was in a vertical position, and an examination of the fracture with a probe in the socket and the fingers under the mandible revealed only a thin layer of bone below and at the sides of the socket, and the mere wedging in of the point of the elevator previous to any attempt at levering, was sufficient to cause the fracture. My surprise was not so much at having broken the bone, as at having done so before any force had been applied. The patient had lost all the maxillary teeth except the front six and the second left molar which occluded with the corresponding one in the mandible, so next day Angle's fracture bands were applied to the four canines and ligatures passed, with the teeth normally occluded. The socket was syringed out night and morning with peroxide of hydrogen. There was considerable swelling and neuralgia, and I had rather an anxious fight with sepsis ; but in spite of this and the exfoliation of a large number of thin pieces of bone, the fracture united in seven weeks. Instead of a displacement of half-an-inch or more, which so often accompanies fractures of the mandible, the patient's complaint was that, although she could just grip a piece of cotton between her incisors, she was unable to bite it through, as had been her habit.

There is a moral attached to this case. There was some unpleasantness over the accident and I feel that some of the complaints were justified. One was that nothing had been said to the patient about such an extraction being different from or more difficult than any ordinary one, and secondly the patient had naturally supposed that her dentist was to operate. Particular stress was laid on the fact that neither she nor her relatives had consented to my operating, and that I should therefore have refused the request of the dentist to do so. It was of no avail to point out that if the accident happened in my

hands, it would have been still more likely to happen in those of her dentist, who had never previously seen a case of impaction. Quite apart from the legal aspect of the question, I feel strongly that the patient (or the patient's friends) has a moral right to know who is to operate, and also whether there is likely to be any difficulty.

In these days when dentistry has grown so large that specialisation is becoming a necessity, it is a matter for astonishment and regret that a dentist, who dislikes extracting, or who from want of practice cannot do it satisfactorily, does not openly and honestly call in a specialist. The general medical practitioner does not consider that he is showing incompetence and risking his patient's faith in him by calling in someone with special skill and knowledge, nor is it conceivable that he would stoop to take credit for an operation performed by another.

I have met with two cases of the impaction of third maxillary molars under the necks of the second molar, the teeth lying at an angle of about forty-five degrees. Both cases occurred in women over forty, and in both there had been long-continued neuralgia, and more recently suppuration. In both cases the teeth were easily removed with forceps, and there was no subsequent trouble.

I have also met with an interesting case of unerupted third maxillary molar. The patient, a lady aged about fifty, had worn a full upper vulcanite denture for twelve years. Some seven years ago there was inflammation and pain on the left side, which was attributed to the denture, and it was eased on the facial aspect. The attacks recurred at intervals, and latterly during these attacks, the patient experienced severe pain when attempting to open or close the mouth. Coming to Edinburgh, she sought Mr Robertson Campbell's advice during an acute attack, and after careful examination he discovered a sinus on the facial side of the tuberosity, and, having passed a probe along it, was able to detect dental tissues. I was asked to see the case and confirmed the diagnosis. The probe passed along the sinus for three-eighths of an inch before touching the tooth. From the history of the case and knowing that a third maxillary molar, if lying abnormally, usually does so with the crown presenting facially, I came to the conclusion that the tooth was probably lying horizontally, with the crown projecting into the attachment of the pterygoid muscles. I attempted by means of a sharp, rigid probe to confirm this, but as there was no doubt that there was a central depression directed downwards with divergent walls surrounding it, I became pretty certain that the tooth was vertical with the crown presenting downwards, and although the tissue was not smooth enough for enamel, I thought that the slight roughness might be due to rarefaction such as I have met with several times in unerupted canines, or that it was due to a deposit of lime salts from the pus. The patient was etherised, and an incision made through the sinus forwards and inwards over the tuberosity. With a sharp elevator the outer part of the tuberosity was gouged away, until a large area of the tooth was easily outlined. Being anxious not to open into the maxillary sinus on the one hand, nor to lever off the pterygoid plates on the other, I relinquished the elevator and applied forceps. The blades were kept closely to the tooth and opened more and more widely, until I was able to get hold of it, and by a little manœuvring it was brought away, being held between the occlusal surface and the apex of the roots. The tooth

had been lying horizontally, with the crown looking outwards and backwards, and the supposed central depression of the crown turned out to be a conical area of very smooth rarefaction. The wound healed up with very little discomfort in three weeks.

Some other methods of extraction may be briefly alluded to. For instance, one not infrequently meets with patients, who have possibly been wearing full dentures over a few scattered and perhaps abscessed roots, which may be the remains of roots that have been fractured during extraction. These little pieces of root are not so frequently met with in the mandible, and when they are, are usually best removed with forceps or elevators. In the maxillæ, however, they are more common and are sometimes better treated in other ways than those advocated in the preceding pages. If the root is the lingual one of a molar, it is usually removed most easily and safely with forceps. There occur very rare cases, however, where it is impossible to use forceps. For instance, the facial roots of the first permanent molar may be absent, but the carious lingual root may be buried deeply under gum, between and to the lingual side of the second molar and second premolar, which have approximated so as almost to obliterate the space normally occupied by the first molar. In these cases forceps are out of the question, and the root is best removed with a large, strong, suitably shaped excavator or enamel chisel, carefully insinuated up the side of the root. If, on the other hand, the root is to the facial side of the alveolus and is completely covered with gum, and one can be reasonably sure that it is a short piece, it is often best removed by making an incision along its length, and then forcing a large excavator or enamel chisel between it and the lingual wall of the socket, thus pushing it through the incision.

There is a fact well worth bearing in mind **in extracting the three separated roots of a maxillary molar** when the tooth mesial to them is standing—usually the second premolar. It is a common occurrence to see two of the roots removed and then a difficulty arise in finding the third one. Almost invariably in such cases the two removed are the disto-facial and the lingual roots, because they are most easily seen, and reached by the forceps—the tooth in front obscuring the view of the mesial root. If there be any doubt then, and time short, as in a nitrous oxide case, the operator will find that he is right in ninety-nine cases out of a hundred if he goes for the mesial root. It is best to make it a rule to extract the mesial root first, as the visible distal one is a guide to it, and then to extract the other two in the order that the special conditions of each case indicate to be the better—usually first the facial and then the lingual one.

CHAPTER VIII

EXTRACTION OF MILK TEETH

THE technique for the extraction of the milk teeth differs in no essential from that of the permanent set. At the time, however, when these teeth need to be extracted, their roots have usually absorbed to a large extent, their sockets have almost disappeared, and the succeeding teeth are in close proximity (fig. 47).

Whether forceps or elevators are used, the conduct of the left hand is exactly the same as for the removal of the permanent



FIG. 47

Shows milk teeth *in situ*. Note relation of the roots to the crowns of the developing permanent teeth.

teeth in the corresponding positions in the mouth, and the forceps and elevators used are the same and are held in the same way. It is, however, commonly advised that the instruments should be smaller and lighter; but this is quite unnecessary. The only difference in the technique is that owing to the ease with which the teeth are dislodged, it is never necessary to drive the blades forcibly into the socket and thus run the risk of damaging the permanent successors. If the tooth is not decayed (at least at

the parts that are engaged by the forceps), it can usually be removed almost without touching the gum.

As in the case of the permanent teeth, forceps should be used whenever possible ; but an elevator is often the best instrument for dislodging semi-necrosed roots, not only in the mandible, but also in the maxilla. In hospital practice, one meets with a large number of cases in which the necrosed roots protrude through the gum, most commonly those of the maxillary incisors and the mandibular molars. There are two good methods of dealing with these roots. They can be extracted with forceps in the usual way ; but if, as is usually the case, the crown is absent, and the root badly decayed, a much better plan is to make a vertical incision through the band of gum encircling the cervical half of the root, to place the blade of an elevator or of a pair of forceps between the necrosed apex and the alveolus, and to push the root outwards through the incision. A further stage of the same process is seen when the whole length of the facial aspect of the root is necrosed and laid bare of its coverings. This condition is frequently seen in connection with the roots of the mandibular molars, the apices of which may be causing ulceration of the cheek. The root is best removed, as indicated above, by means of the blade of an elevator or forceps placed under the apex of the root, thus lifting it upwards and outwards.

The retention of the lingual root of one of the maxillary molars, especially of the second, even for several years after the eruption of the permanent teeth, is of fairly common occurrence. It is often in close apposition to the mesio-lingual angle of the first permanent molar, and caries is frequently induced in the molar by food lodging between it and the milk root. More frequently, however, the root at an early period is so carious as to lie below the level of the gum. It is generally less than 5 mm. long, and if presenting above or level with the gum may be removed with forceps, but it is usually most easily dislodged with an elevator or large excavator and with a minimum of damage and of pain.

It is a common but mistaken belief that a milk tooth must be easy to extract. The removal of a number of pieces of milk teeth, scattered around the alveolus, some of them in close proximity to or wedged between erupting permanent teeth, may require skill and judgment. Moreover, in the case of the molars, the premolars are developing between the roots of each tooth, and should caries be extensive, the milk tooth may break up under the pressure of the forceps, which the operator quite rightly refrains from forcing too far up the root, where he might obtain a firm hold. When this happens, the crown of the successor can often be seen or felt with the forceps, and great care must be taken not to injure or dislocate it. The forceps can

usually be again applied to the roots ; but it is sometimes safer to dislocate the loosened roots with an elevator applied to the neck of the tooth or, to save changing the instrument, one blade of the forceps can often be used as an elevator. If more of the root is projecting lingually, the lingual blade should be used and the root displaced facially, whereas if the root projects higher on the facial side, the facial blade should be used to tilt the root lingually. In dealing with these cases of extensively decayed teeth which break up under the pressure of the forceps, the efforts of the operator should be *especially directed to the extraction of the lingual root*, as it has usually undergone less absorption than the facial ones. Consequently, any fragments of the facial roots which remain are likely to be loose in the gums, and will come away of themselves or can be removed even by the child ; but the lingual root, if left, is likely to require extraction later on.

Occasionally it happens that milk teeth require removal before there has been any appreciable absorption of their roots. This may result from the patient's being too young for the process to have occurred, or it may result from absence of or insufficient absorption at the time when it should have taken place. The former case is all too frequently seen in hospital practice, where owing to ignorance and neglect the molars are often abscessed and past redemption at the age of four or five. One should take a large view of dental surgery, and not act, as so many of us do, as though the body were an insignificant appendage to a tooth. Accordingly, there must be no hesitation in extracting all such teeth, even if it leave the child almost, if not quite, edentulous ; for they are functionless from disease and pain, and the child is much healthier without them and freed from the dangers of serious sequelæ. As, however, the fully developed roots of milk molars diverge abruptly from the neck of the tooth to accommodate the developing successors, while their apices are often recurved under them, great care must be taken in removing them not to displace the premolar. As will be seen in another chapter (page 114) the operator may not be able, even with the greatest care, to prevent the complete or partial dislocation of the premolar owing to its being securely gripped between the roots of the milk teeth.

The canines, especially the maxillary ones, present the most common example of non-absorption of the root at an age when it should have occurred. It has no other surgical significance than that the tooth will be more firmly implanted and consequently require rather more force than usual to loosen it.

CHAPTER IX

DIFFICULTIES AND COMPLICATIONS

THE extraction of teeth in the majority of cases is, with a proper technique or even without it, a simple operation and unattended by difficulty, complications, or serious sequelæ.

Such, however, is not always the case, and the dentist like any other surgeon sooner or later learns that even the simplest of operations may present great difficulty and be the source of much anxiety. Hence, even the most trivial operation should not be undertaken without due consideration of all the circumstances bearing upon it, and without adopting every precaution to ensure success.

Writers upon the extraction of teeth enumerate a large number of difficulties, complications, and sequelæ attending the operation, many of which must be very rare. One of the commonest difficulties and one that frequently leads to further complications **is undue difficulty in loosening the tooth in its socket.** Every operator knows that the various teeth normally require an unequal amount of force to loosen them. For instance, the average maxillary canine requires many times the energy to move it that the maxillary third molar does. One who has watched a large number of dentists operate, must be struck by the fact that what may constitute an insuperable difficulty for one may be the simplest matter for another. I have seen students and dentists in a profuse perspiration relinquish the attempt to loosen a tooth, after misapplying an amount of energy that, if properly applied, would have been sufficient to loosen a really firm tooth a dozen times over, and then another operator by well-directed efforts loosen it with ease. It cannot be impressed too strongly upon students that to be successful they must attack every extraction with the full confidence begotten of knowledge, and with the recognition that a case apparently simple and straightforward may, by sheer neglect of reasonable precautions, end disastrously.

There are several factors that may transform what is a difficult extraction for one operator into an easy one for another, and they have been sufficiently indicated in previous pages. Only one factor need be mentioned here, as it has not been considered elsewhere, viz., the muscular development of the operator,

especially of the hand and forearm. Attention has been already directed to the enormous amount of wasted energy often expended in extracting a tooth, and this commonly happens with operators whose fingers are not strong enough to keep the handles properly closed. When lateral strain is thrown on the tooth, the lingual blade repeatedly slips off, increasing at each attempt the difficulty of the operation by breaking off fragments of tooth, and by putting the operator into a rapidly increasing state of nervousness. Possibly the time will come when students will be taught to prepare cavities for filling mainly with keenly sharp hand instruments, instead of flying to the barbarous engine, and then the muscular development of the fingers that will rapidly ensue, together with the high pitch to which the muscular sense will be developed, will eliminate one only too common cause of difficulty in extracting teeth. The bulk of extractions do not require a great deal of muscular exertion ; but some cases do, and occasionally one meets with a case that requires what might be called an enormous amount of force. Thus, I was asked to extract a maxillary first permanent molar for a powerful young man, who in eating game had fractured the tooth mesio-distally. The teeth were large and the dentition was complete. The dentist had injected an analgesic and found so much resistance to his efforts to loosen the tooth that, fearing to increase the difficulty of the extraction by breaking off the crown, he desisted. Upon making an attempt myself, I was quite unable to loosen the tooth in the usual way. The patient, who was feeling no pain, fortunately seemed thoroughly to enjoy "the sport," and it was only by getting his head rigidly fixed, and applying an almost alarming amount of force that the tooth was successfully loosened and dislodged without damage to surrounding parts.

It is, however, **isolated teeth** which have not been loosened by the tissue changes resulting from chronic pericementitis that are apt to offer abnormal resistance to extraction, owing to the compensatory hypertrophy that follows on the loss of the support normally afforded by one tooth to its fellow. The hypertrophy consists in the calcification of the medulla of the bone, thus converting what is normally comparatively soft cancellous bone into the dense compact variety, which does not readily yield when lateral force is applied to the tooth. Such teeth should be approached with great care. The tooth should be very firmly grasped, and the blades pressed into the socket with considerable force. The appropriate movements should be made very gently, and the force applied gradually increased in proportion to the resistance encountered. In this way the tooth may usually be extracted, even when the roots are long and slender.

Nothing, however, is more disastrous than "snapping" at

such a tooth or than allowing the blades to open even to the slightest degree, as in either case the tooth is almost certain to be fractured. It has been already pointed out that in order to extract almost all firmly implanted teeth *in toto*, the bone must either bend or fracture. One sometimes finds that the force required to loosen the tooth in the socket is greater than the stress the tooth will stand, with the result that it fractures usually across the neck, but sometimes half-way along the root. It is obviously an unavoidable accident, and will occur with the most skilful operator. The teeth that most commonly present difficulty from changes consequent on isolation—changes that may not be confined to the bone—are second mandibular molars, second mandibular premolars, and maxillary canines.

Another source of difficulty may be in divergent and twisted roots. Twisted roots are rarely a cause of undue resistance, but rather of fracture; **divergent roots**, however, may present difficulty in extraction. This difficulty can really occur only with the molars; for the maxillary premolars, the only other teeth likely to have more than one root, have approximately parallel roots, which are relatively slender, so that they fracture rather than cause undue resistance to removal. Of the mandibular molars, it is naturally the first or second that presents this difficulty, and if the technique advocated in the preceding pages is adopted, it is one that matters but little; for one of two things should happen. The tooth having been firmly gripped by one root and leverage applied, then if sufficient force is used, the two roots will be loosened and removed together, or if the uniting tissue be weaker than the stress applied, fracture will occur between them, and the root gripped will be removed. The second root can then be readily removed with forceps or an elevator. The great advantage is that, whichever happens, one root at least is removed at the first attempt.

In the maxillary molars all three roots may be abnormally divergent; but the lingual root may be the only divergent one, and in any case it is the divergence of this root, rather than of the facial ones, that leads to difficulty in extraction. It is most commonly the first molar that presents this feature, and the possibility of four very divergent roots must not be lost sight of. When such a tooth is decayed as far as the neck or broken off there, the angle at which the root lies may prevent the lingual blade of the forceps from obtaining a secure hold (fig. 16 A). All the more reason then for the constant injunction to “push up, whilst carrying the forceps facially, so that the lingual blade shall not slip off.” If this advice is acted upon with vigour, the desired end will probably be achieved, or the tooth, as a result of the compression of the forceps, will be fractured into two or

three separate roots, which can usually be readily removed. There is no need to separate such roots with a bur or splitting forceps, as is frequently recommended in text-books.

“Twisted roots” or roots with sharp curvatures, do not usually increase the difficulty of loosening the tooth. Owing to the cancellous nature of the sockets, roots may be safely delivered with the most extraordinary curvatures upon them, without undue exertion. On the other hand, if the bone is too resistant to let

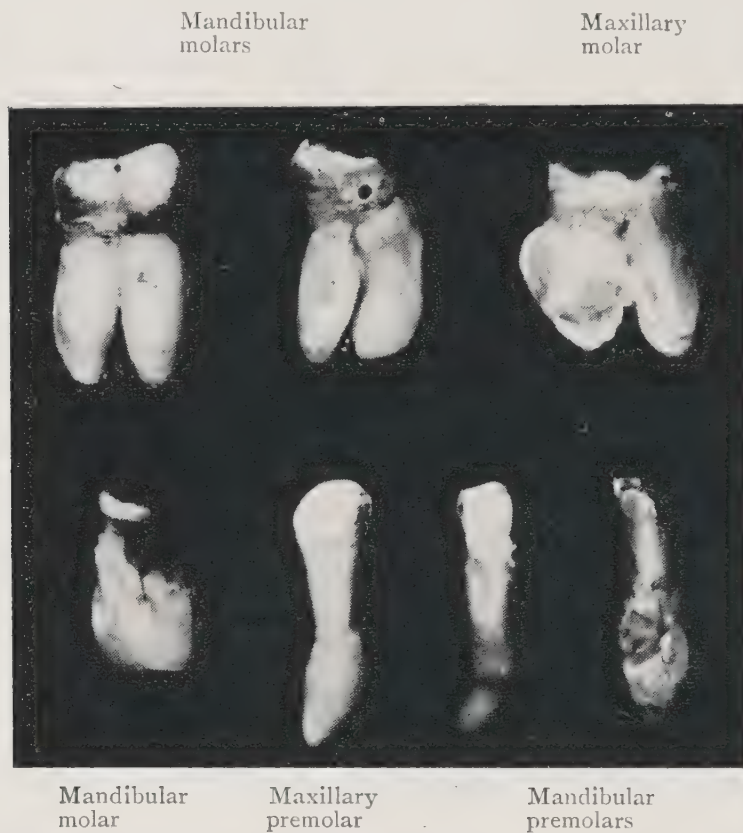


FIG. 48

Cemental hyperplasia, the result of chronic pericementitis, leading to thickening of the roots. This may lead to difficulty in extraction, even after the tooth is loosened, and also to fracture, especially when the new tissue is bulbous.

the bent root through, fracture must occur at the point of least resistance. Pronounced bends are more commonly met with in some teeth than in others. Thus the maxillary third and second molars frequently have the apices of the facial roots bent distally; less commonly the lateral incisor, canine, and second premolar are sharply curved distally, while sharp curvatures on the other maxillary teeth are rare. In the mandible, sharp curvatures are almost confined to the roots of the third and second molars, though they are sometimes met with in the premolars.

Another cause of undue resistance is **cemental hyperplasia**—a condition met with far more frequently in the molars and premolars than in the other teeth. In this condition, especially when confined to the apical region, the root may become loosened quite readily, and yet considerable resistance to its removal be met with (fig. 48).

Cemental hyperplasia leading to union of two or more neighbouring teeth is not common, and probably only occurs in the molar region, and then most commonly between the second and third maxillary molars (fig. 49). I have met with only a few



FIG. 49

Ankylosis of teeth, the result of chronic pericementitis. Usually there is an accompanying rarefying osteitis, so that the extraction is not difficult, but there may be some laceration of the soft parts.

cases. In the cases where the third molar was unerupted, there was more resistance than usual to the removal of the second molar, but in no case was the extraction a difficult one.

Ankylosis of the root to the bone is a rare condition, and only some dozen cases have been recorded. The author has never to his knowledge met with a case ; but he has two specimens of it which were sent to him by old students, one of which he has described and figured. Judging from what one hears from patients, this condition is evidently frequently given as the explanation of fractures and of difficult extractions which have been relinquished. So far as the author has been able to ascer-

tain, in none of the cases recorded was there any undue difficulty in the extraction, the only feature being the removal with the tooth of a larger or smaller portion of bone attached to it, which maceration or histological investigation subsequently proved to be ankylosed.

The extraction of **roots badly decayed and half covered with gum** often presents a difficulty, which is wholly of the operator's own making. Very few dental surgeons seem to have any idea of the average diameters of the different teeth at, or just root-wise of, the neck; and despite the teaching of their own experience, they apply their forceps, as though the width of the decayed fragment presenting to the eye represented the width of the root. They pick and pick away, oblivious of the fact that there is under the gum a root to be extracted probably half-an-inch long with a diameter two or three times greater than the width to which they have opened the forceps!

Fracture of a tooth is usually an avoidable accident, but is occasionally unavoidable. For a root embraced by a bony socket to be extracted intact, the socket must, unless the pericementum be very thick, either bend or fracture, especially if the root is irregular in shape instead of being regularly conical. Now, if the resistance of the alveolus to the stress applied be greater than the breaking stress of the root, the root must fracture, and provided that this is the only factor in the accident, no blame can be attached to the operator. The tooth that is most subject to this accident is the first maxillary premolar, it being not at all uncommon for the slender tip of one or both of its roots to be fractured. The apical halves of the mandibular premolars also are buried in dense bone, and they are often fractured at this site or nearer the apices, but the accident is usually an avoidable one.

Other unavoidable causes of fracture are **curvature of the roots and cemental hyperplasia** (fig. 48). The tissue changes incident to advancing age may and usually do render extraction easier; but the opposite may occur. The alveoli may have become denser, the pericementum thinner, cementosis may have supervened and the roots may have become more brittle, all of which conduce to fracture.

The importance of an accurate knowledge of the gross anatomy of the roots has already been insisted on, and particularly in the case of the molars is it useful. **In the maxillary molars if a root fractures, it is in ninety-nine cases out of a hundred the disto-facial one**; and when operating under nitrous oxide anæsthesia, it is of the greatest value to remember this, as it often enables the dentist to complete an operation successfully

that he would not have time to do, if he had to hunt around the various sockets. Of course the properly trained operator, if he suspected a fracture would, whilst the tooth was still in the forceps, make a rapid examination of it, but for those who shake off the tooth into the spittoon or who indulge in the habit of throwing it vigorously on to the floor or at any innocent bystander, it is of value to know which root it is that is most probably fractured. The reason for its being the disto-facial root is that it is the most slender of the three, whilst the resistance to its extraction is increased by the greater thickness of bone that lies facially to it, owing to its being placed nearer the middle line than are the neighbouring mesial roots (fig. 19). Fortunately, the root nearly always fractures at the level of the alveolus and so is readily removed. The next most common root to fracture is the mesial one, and then the distal one is almost always broken too. Fracture of the lingual root, unless greatly weakened by caries, is very rare, but when it does break, it is apt to do so far up in the socket.

In the mandibular molars the distal root is the weaker, and if the crown comes away with one root attached, it is almost certain to be the distal one that has been left behind, but of course the root to which the forceps have been applied will as a rule be the one extracted. The fractures that most commonly occur are, however, avoidable, and due to such causes as the underestimation of the possible difficulty of the task, or the opposite mental attitude extreme nervousness; also the use of unsuitable instruments, a bad technique, or deficient muscular strength. Weak portions of the crown may thus be needlessly chipped off, or the whole crown fractured at the neck, necessitating a further attempt and causing loss of valuable time and possibly increased pain to the patient.

Teeth, the canals of which have been drilled out either simply in the ordinary course of treatment or in order to allow of the insertion of a strong post to carry a crown, are very liable to fracture in attempts to extract them. The roots of such teeth frequently fracture in their long axis, and the tooth in spite of every care may have to be removed literally "in pieces." With regard to any artificial crown that may be present, there is no need to remove it before attempting the extraction, unless it is loose. If it comes off during the extraction, no harm is done, but as a matter of fact it frequently remains attached to the root or roots, unless, as mentioned above, they splinter up.

In preventing fractures, a grip of the handles firm enough to prevent them separating even the slightest degree when the appropriate movement for loosening the tooth is made, is as important as pressing the blades of the forceps into the socket.

It requires a delicate sense of touch and a high development of the muscular sense to apply the correct pressure for each case. The lesser of two evils, however, is to grip too firmly. In fig. 50 the forceps are shown in proper position and the distance between the blades is the shortest possible, viz., the diameter of the neck of the tooth. When lateral pressure is now thrown upon the handles to carry the tooth facially, there is a tendency for the lingual blade to slip crownwards, unless the blade is constantly forced into the socket by pressure transmitted from the palm of the hand, and unless also the handles are grasped firmly enough to prevent their opening.

Why is this slight shifting of the lingual blade crownwards

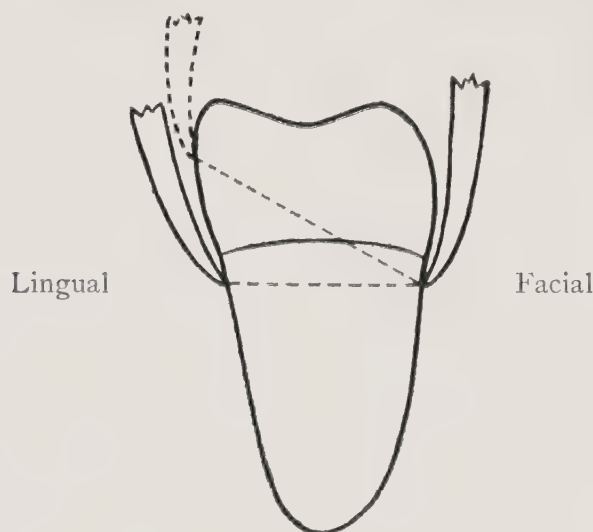


FIG. 50

Represents mandibular molar to illustrate effects of allowing the lingual blade to move crownwards, which can only happen by allowing the handles to open. By turning the book upside down the same illustration will serve to represent a maxillary molar.

so fraught with possibilities of fracture and failure? It is because the conditions obtaining in a lever of the first order are set up, in which the root in the alveolus becomes the weight, the end of the facial blade the fulcrum, and the lateral force transmitted through the lingual blade the power. Now, the greater the length of the lever between the fulcrum and the power, the greater the chances of the lever fracturing, if of a brittle nature. On the other hand, the shorter the length between these two points, the greater the power that can be applied without risk of fracture, whilst, when the length of the arm between fulcrum and power is zero, the lever and all tendency to fracture cease to exist, and the force applied becomes one of compression only. If the blades of the forceps are driven into the socket far enough

to grasp fairly strong tooth substance, and if this pressure is constantly maintained, whilst the handles are firmly gripped, the lingual blade will not slip crownwards, and nine hundred and ninety-nine roots out of one thousand will stand sufficient compression to allow them to be rotated or moved facially or both until quite loosened, when they can be removed from the socket.

All this may be summed up in the golden rule : Make the root part and parcel of the forceps, a rigid prolongation of the blades, so that it participates in each and every movement of the forceps.

The reader will now perhaps better appreciate the grounds for the statement that the great majority of fractures in tooth extraction are avoidable accidents, because apart from these due to over-confidence or extreme nervousness, the great majority arise from the use of badly designed forceps, a faulty technique, or deficient muscular development in the operator.

Removal of the wrong tooth is almost always a matter of carelessness on the part of the operator, though the patient may contribute largely to the accident by unruly movements. The operator should never take his eye off the tooth that he is extracting, until it is safely out of the mouth, and yet how common it is to see a man take hold of the tooth he wishes to extract and then turn his eyes elsewhere, usually heavenwards, until he feels something loosen under his forceps, which may or may not be the tooth to which he originally applied them ! Naturally, should such an accident occur, the tooth extracted is the one anterior to the one intended ; and my own experience is that the accident occurs more frequently in the mandible than in the maxilla, and on the right side than on the left. The reason probably is the awkward position in which the operator usually is when removing these teeth, making it difficult for him to see what he is doing, even if he wishes to. Treatment will depend on the conditions present. Thus when several teeth are being extracted, so that one more or less does not matter, or when the tooth is of no special value, or when it is crippled by chronic pericemental disease, it may be advisable to make no attempt to replant it. If, however, favourable circumstances are present, the tooth should be replaced in its socket with or without removal of the pulp, the alveolus firmly moulded around it and the tooth, if necessary, supported with a splint or ligature for a few days.

Dislocation (partial or complete) of a tooth may occur whilst extracting its neighbour and is usually an avoidable accident. It may occur where there is great crowding of the teeth and overlapping of the crowns, or where a tooth is wedged between two

overlapping teeth, or where the teeth are loosened by chronic pericementitis. Complete dislocation, however, probably occurs most frequently when extracting the first mandibular molar, especially when an elevator is being used "from before backwards," in which case pressure on the conical root of the second premolar may cause its sudden dislodgment. The accident is still more likely to happen in the case of a child of ten or eleven, in whom the root of the second premolar is incomplete and consequently the tooth easily displaced, unless care is exercised.

Another tooth not infrequently dislocated is the second mandibular molar. This occurs in extracting the third molar, especially when the elevator is applied from before backwards.



FIG. 51

Second mandibular milk molar. The developing premolar between its unabsorbed roots was unavoidably brought away with it.

The second molar may have only one conical root, so that it is easily dislodged.

Where there is any likelihood of dislocating a neighbouring tooth, the operator must be on his guard, and upon the first sign of the tooth moving in its socket, it must be firmly supported, generally by the thumb and forefinger of the left hand, whilst it may be necessary to apply force to the condemned tooth in a different direction, and to use different instruments, *e.g.*, change from an elevator to forceps.

Removal of Unerupted Tooth. The premolar is the only one to which such an accident is likely to occur. It develops between the roots of its milk predecessor, and should the milk tooth be extracted before most of the roots have been absorbed, the removal of the premolar with it may be an unavoidable accident. Such a case is illustrated in fig. 51.

During the extraction of a milk molar at a later stage, damage to the underlying permanent tooth may occur, short of its actual removal, by the formed part of the tooth being dislocated on the germinal portion.

Fracture of one tooth in extracting another must of necessity be a rare accident, if the technique advocated in these pages is adhered to. In fact, the only cases in which I have seen it occur and almost the only cases in which it could occur are two, *viz.* :—

(1) If the crown of a tooth, say of a central incisor, or the space normally occupied by it, is encroached upon by the neighbouring teeth, then unless care be taken not to carry rotation or any facio-lingual movement too far, the sides of the blades of the

forceps may crumble off a corner of one of the neighbouring teeth.

(2) In extracting a crowded mandibular incisor, a pair of forceps with broad blades may fracture neighbouring teeth. In the cases in which such a tooth has to be extracted, a special pair of forceps (74N) may be necessary (fig. 4).

A neighbouring tooth is rarely fractured by the use of an elevator, the harm done being generally of the nature of contusion and laceration of the pericementum. In exceptional cases, however, a conchoidal fracture of part of the root or neck may occur.

Fracture of bone. Where normal conditions of tooth and alveolus obtain, in an adult at any rate, it is probable that more or less solution of continuity in the alveolus occurs in the majority of cases of extraction, although owing to the excellent blood-supply, necrosis and separation may not follow. On the other hand, it is not at all uncommon for small spicules of bone to come away even after a simple extraction, and it is astonishing what an amount of groundless alarm this may give rise to in the mind of a patient. We have probably all of us lost unreasonable patients from this trivial accident; but the philosopher will console himself with the reflection that if he loses a patient on this account, he probably gains one of someone else's.

Contusions and fractures of bone on a larger scale may be avoidable or unavoidable accidents, and apart from their clinical interest they have unfortunately of late years acquired a medico-legal interest out of all proportion to their seriousness, and in fact the number of actions for damages or of threatened actions is not only becoming a nightmare to the conscientious dentist, but is positively interfering with the best treatment of the patient. The statistics of the medical and dental protection societies show that the claims of dissatisfied patients for damages for trifling or imaginary injuries are rapidly increasing; and as one never knows when one's own turn will come, such a society should be joined by every practitioner at the commencement of his career.

For the present state of affairs, however, the dentist is himself largely responsible. For some inscrutable reason it is the rarest thing for a dental surgeon candidly to confess to his patient, for instance, that the tooth has broken in the attempt to extract it, or that the gum or bone has been unavoidably damaged to a greater extent than is usually necessary. It is equally rare for him to warn a patient beforehand that the operation will probably be an unusually difficult one, and that consequently there may be some, and perhaps considerable, post-operative discomfort and pain. There is no necessity to go to the other

extreme and terrify a patient or his friends when an operation is necessary ; but the dental surgeon could usually say a great deal more than he does, both in justice to the patient and to himself, without any danger of this. Many dentists do not hesitate to say that everything is all right, even when they know that an accident such as a fracture of the root has happened, which sooner or later *must* come to the knowledge of the patient. Is it any wonder that the word of the dentist, in his professional capacity, is not trusted, and that the public has come to believe that if anything untoward happens, no matter how unavoidable, he is to blame ?

A small spicule of bone during the process of being thrown off, may give rise to some discomfort and pain, perhaps from causing scratches of the tongue or cheek or by setting up a very localised but acute inflammation in the gum in which it is entangled, rendering the part very sensitive when anything, such as food, moves the splinter about or presses on the inflamed spot. Treatment consists in grasping the splinter firmly with a pair of strong tweezers and jerking it suddenly out. It is one of those little sore things that should be done quickly and that should never require a second attempt.

Larger fractures of the alveolus are usually avoidable accidents and are comparatively rare, if the operator follows the technique, so often insisted on in these pages, of *forcibly gripping the alveolus* over the tooth which is being extracted between the forefinger and thumb of the left hand. In this way the attachment of the muco-periosteum to the bone is supported, and the solution of continuity occurs through the pericementum ; and even although the alveolus may be fractured at the thinnest part, it retains a good blood-supply and lives. When a large piece of alveolus comes away attached to a tooth, the dentist often consoles himself with the reflection that " it would have absorbed anyhow." This is true to a certain extent, but no one will gainsay that the less alveolus thus torn away, the better the chance of the patient's having a painless recovery and of having a full, even, alveolar ridge on which subsequently to support artificial dentures. Large pieces of alveolus may, however, come away with a tooth, in spite of every care. Thus I administered an anæsthetic for a dentist for the extraction of all the maxillary teeth in a man of about twenty-five. The dentist removed one of the third molars, bringing away with it a large piece of bone, practically the maxillary tuberosity. He asked me to continue the operation, and in spite of all care the whole facial alveolar plate came away over each molar and premolar, leaving the gums hanging loose. Examination of the specimens showed the alveolus at the gingival border to be enormously thickened, whilst at its junction with

the body of the bone at the apices of the teeth, it was absent or as thin as paper. Moreover, it was extraordinarily adherent to the teeth, whilst it stripped off the muco-periosteum readily.

A similar anatomical arrangement of the parts may explain the removal or loosening of one tooth, when extracting its neighbour. I was recently asked to express an opinion on a specimen consisting of a badly decayed first maxillary molar and a sound second and third molar which had come away in one piece, on an attempt being made to remove the first molar. The dentist contended that no unusual force had been used, and I was quite ready to believe him, as the teeth at the gum margins were bound together by a thick band of bone, whilst the apices of the facial roots had evidently been merely under the muco-periosteum, the bone between them being as thin as paper. From an examination of the specimen I was able to express the opinion that the operation had been performed with skill and every care, and that it was reasonable to suppose that the accident had been unavoidable.

The teeth to which bone, usually consisting of the facial plate, is most likely to be attached are the molars and maxillary canines (fig. 52). In extracting the third maxillary molar, the tuberosity may be torn away with it, leading to considerable laceration of soft parts and possibly to profuse hæmorrhage. In such cases the general tendency amongst dental surgeons is to desist, after a good deal of damage has been done in half-hearted attempts to remove the tooth alone, and in one case at least this state of things resulted in a dentist appearing in the law courts.

I once removed a large portion of a left maxilla from a man in the following circumstances. A dentist in the country was removing a number of roots preparatory to inserting dentures, and the second molar being the only tooth with the crown remaining, it was decided to extract it also. The parts had been injected, and when the attempt was made to extract this tooth, an extensive fracture of the bone, involving the hard palate, occurred high up on the alveolus. The dentist, who brought the patient in to me at once, told me that he had applied no more than the usual amount of force, and this was readily confirmed by the patient, who was quite satisfied that it was an unavoidable accident. After freeing the muco-periosteum with a knife around the necks of the second and third molars, the fragment was held steady by gripping the crown of the second molar with extracting forceps, and the muco-periosteum stripped off it by means of a periosteal elevator. When the maxillary sinus was thus opened into there was a gush of two or three drachms of stinking pus, and inquiries elicited a history pointing to maxillary sinusitis of some two years' duration. Examination of the specimen showed that the bone was as thin as paper along the line of fracture, whereas over the roots, especially on the lingual side, it was thick and nodulated.

Should the operator discover that bone has been fractured and that more than the tooth is moving, he should at once desist from attempts to remove the tooth and determine the amount of

injury, which may be very extensive (Salter, Cattlin, Matheson, etc.). Whilst still retaining hold of the tooth with the forceps, he should gently and slightly move it in various directions, at the same time carefully palpating the extent of the fracture with the forefinger and thumb of the left hand. If the fractured portion is very extensive, it may be possible to support the fragment sufficiently firmly with the left hand to complete the



FIG. 52

Fractured alveolus attached to the roots of teeth. In most cases this can be avoided by very firmly grasping the alveolus between the forefinger and thumb of the left hand. (A) and (D) maxillary canines. (B) and (C) third maxillary molars. (E) and (F) second maxillary molars. In case (F) the fractured facial plate made a large opening in the bony wall of the maxillary sinus, which was left rigidly alone and healed up normally.

extraction without further damage. If not, attempts at extraction should be desisted from, and, if necessary, a splint applied until union occurs, which fortunately is very rapid in the maxilla. If, however, the fractured bone is recognised to be small, *e.g.*, the tuberosity, I am strongly of opinion that it should be removed, unless the tooth can be readily dislodged from it; but this is rarely the case or the accident would not have happened. In removing it, as little damage must be done to the soft parts as possible. Sometimes they can be firmly grasped between the

left forefinger and thumb, and by holding the tooth in the forceps, the bone can be safely twisted off them ; or whilst the tooth is gently dragged on by the forceps, the soft parts may be stripped off by means of an elevator, or suitably shaped enamel chisel or spatula used as a tissue separator.

When a piece of bone is removed with a maxillary molar, examination of its inner surface may show evidences that part of the wall of the maxillary sinus has been removed. Thus the bone lodged between the three roots may present a smooth, bare, cup-shaped depression. Similar appearances may some-



FIG. 53

Rarefaction, the result of chronic pericementitis, leading to shortening of the roots, and usually to ease of extraction.

times be seen on the inner surface of the facial plate of the alveolus, when a large piece of it has been removed (fig. 52, F). There seems to be a general impression that in such cases the sinus itself has been opened into, and although I cannot adduce positive proof that such is not usually the case, there is good prima facie evidence for believing so. One finds that if such cases are rigidly left alone, without making any attempt to pass a probe or to syringe out the socket, everything heals up in a normal fashion. Probably in the majority of cases, the bone is stripped off the loosely attached mucous membrane of the sinus, which remains intact. Even if the mucous membrane should be

ruptured, it is probably of the nature of a rent, the edges of which remain fairly in apposition, the protection being made still more complete by the blood clot which fills the empty socket and by the falling in of the gums. The treatment then in any case is to leave well alone, and to content oneself with prescribing the frequent use of an antiseptic mouthwash to keep the deeper parts of the blood clot sterile, until repair has taken place. The patient is thus none the worse, even if later it be found that the sinus is infected. Occasionally it is at once evident that there is a communication with the sinus, the whistling sound of air being heard, or blood, or lotion used to wash out the mouth, passing out through the nostril. Of course, from the possible anatomical relationship of the apices of the molar roots to the floor of the sinus, such an accident may happen without any fracture of bone, the pericementum being in continuity with the mucous membrane. These cases should also be treated expectantly, and then they almost invariably heal without infection of the sinus.

Reference has already been made to extensive fractures of the maxilla during the extraction of a tooth (*vide* p. 118).

In the mandible, the junction of the alveolar process with the body of the bone may be weak in the incisor region, and unless care is taken to grasp the alveolus firmly with the finger and thumb of the left hand when extracting a firmly implanted canine, a horizontal fracture may occur at this spot, loosening the incisor teeth. Should this accident happen, a splint must be immediately applied and retained, until union has occurred. In the molar region, transverse fractures through the horizontal ramus have been recorded as having occurred during the extraction of normally placed teeth, and cases have already been referred to occurring during the removal of impacted third molars (page 99).

The author has met with a few cases of a peculiar fracture of the alveolus occurring *in* the cancellous tissue, and resulting in the tooth being extracted with one or all the roots clothed with a prickly covering of bone.

Dislocation of a tooth or more commonly of a root **into an abscess cavity** may occur, though it is an uncommon accident. The few cases that I have seen have all occurred in the maxilla in connection with molar or premolar roots, and in each case the operator was under the impression that the root had passed into the maxillary sinus. Naturally for such an accident to happen, the abscess must be a relatively large one, and one occasionally meets with abscesses in the maxilla large enough to justify the fear that the cavity is indeed the sinus. In these cases, however, there are or have been usually a large number of

roots present, and the extensive abscess cavity may result from the coalescence of several small ones. The treatment is to open the abscess freely and to remove the root with tweezers, or to scoop it out with an instrument, or even to syringe it out.

Similarly a root may be forced into the cavity of a dental cyst—the treatment so far as the root is concerned is the same.

Dislocation of a root into the maxillary sinus also occurs. The roots of the first molar are most intimately associated with the floor of the sinus, next come those of the second molar and the second premolar. When one considers the anatomical relationships, the rarefaction of bone that may occur as a result of pericementitis, and the upward pressure that is exerted in driving in the blades of the forceps, the accident might be expected to happen oftener than it does. The only case that I have met with occurred in my own hands, and as it is somewhat instructive and unique, it is worth relating in detail.

One evening at seven o'clock, a dental surgeon telephoned that he had broken the crown off a first right maxillary molar just below the gum, that the patient had had severe toothache and had to catch a train in half-an-hour's time, and begged me to come at once.

An analgesic had been used, but had been only a partial success. Examination showed that the tooth had been fractured across the floor of the pulp chamber and that the roots were all still apparently united. Nitrous oxide was administered, and opening the blades of the forceps widely, I forced them up and, closing the handles firmly, brought away one root, which from its position was the mesial one. I wiped it off the forceps on to the towel, and the dental surgeon and his assistant as well as myself saw it. The patient's legs had been placed one on each side of the chair, and unknown to us, he had managed to get sufficient grip of the floor with his toes to force himself back slightly in the chair. Just as I was applying the forceps to remove the lingual root, his right foot slipped, and his head came down suddenly about an inch, causing sharp contact between the blades of the forceps and the socket. The concussion though sharp, was not excessive, the amount of the slip being but slight. The forceps were reapplied and the lingual and then the distal root removed without difficulty.

The patient having recovered, was anxious to see the roots and we were able in the few minutes at our disposal to find two of them, but not the third. As the three of us, however, had seen three roots come out, we assured him that all three were away, and he hurried off in a cab. We were all anxious for our dinners and did not trouble to hunt for the missing root.

Nothing more was heard of the case for some months, and then we learnt that the socket had not completely healed up, and that there had been a constant discharge of pus. The patient saw a dental surgeon in London, who was able to pass a probe through the socket into the sinus. A radiogram was obtained which revealed nothing abnormal, but a second one showed a root lying on the floor of the sinus.

Subsequently a London surgeon removed part of the wall of the sinus and then removed the root. Being absolutely positive that three roots had been removed at the operation, we sent for the root that had been removed for examination, and it confirmed our suspicions that the tooth must have had four roots; for the root was undoubtedly a mesio-lingual one. Probably it was driven into the sinus when the patient's foot slipped,

at the moment when I was reapplying the forceps, so that the collision occurred between the root and the lingual blade of the forceps, whilst the empty socket of the mesial root received the facial blade. Supposing that the end of the root were already projecting into the floor of the sinus, one can easily understand how a short, sudden impact might drive it into the sinus. The patient, as one might expect, was wroth at our "carelessness," and it was a pleasure to learn that, although our London confrère did not know all the circumstances of the case, he stoutly maintained to the patient that the forcing of a root into the sinus might occur without any negligence on the part of the operator. The patient, again quite naturally, made much of the fact that we were able to find only two roots after the operation, and perhaps it requires a dental surgeon really to appreciate the weakness of such an argument; for who amongst us has not hunted not for one minute, as occurred in this case, but for a long time, moving all the furniture in the room, without ever finding the much-sought-for tooth or root?

In this connection, an interesting episode occurred recently. I administered nitrous oxide for the removal of two molars, placing a Hewitt's mouth prop (joined by a foot of chain to another one) between the front teeth. The operation being completed, the mouth props were nowhere to be found, and as I was going on to another case for which I would require them, the patient, the dental surgeon and myself spent fully ten minutes hunting for them, but in vain. Next day the props were returned to me—they had been found in the side pocket of the patient's coat, into which they had evidently fallen. In another case, I extracted a second maxillary and a second mandibular premolar, both in complete lingual occlusion, from a boy of twelve. Being anxious to examine the teeth, the patient, his doctor, and I hunted for one of them for half-an-hour without success, the search including almost the complete undressing of the boy. Next day the patient told me that he had found the tooth inside his shoe, when undressing at night.

Every dentist could tell of similar experiences, and they have great medico-legal interest.

A tooth or root in the maxillary sinus should, if possible, be removed and the sooner the better. It will probably be necessary to increase the size of the opening, and there is no harm in making a fairly large one, as it facilitates the operation, and there need be no fear of its not closing, the difficulty always being to prevent this happening. An attempt may then be made to wash the root out with a strong stream of water. Even if this does not completely dislodge it, the stream will probably carry it to the vicinity of the opening, and it may then be scooped out with a loop of wire, and if its long diameter be greater than the width of the opening, one end must be brought down first.

It is recommended by some to leave a root alone, if difficulty is experienced in recovering it, in the hope that it will become encysted and give no trouble. Such treatment, however, seems somewhat irrational; for such a root can rarely be aseptic, and even irrigating the sinus for a few days is not likely to make it so. Moreover, seeing how readily wounds of the maxilla heal up, it is better to make an opening large enough to remove the foreign body, even if it involves raising a muco-periosteal flap, thus eliminating the chance of subsequent chronic suppurative

sinusitis, and the possible risk of malignant disease, following on chronic irritation.

Dislocation of the temporo-mandibular articulation may be an unavoidable accident, but is usually avoidable. One meets with patients in whom dislocation occurs whenever the mouth is opened beyond a certain narrow limit, and in patients with a shallow glenoid fossa, the condition is easily brought about. It occurs usually when extracting mandibular teeth and is often an evidence of faulty technique, inasmuch as the mandible has not been properly supported with the left hand to counteract the downward pressure of the forceps. There is also a tendency on the part of the operator to draw the mandible forwards at the same time, so that dislocation very readily results. It may occur from the insertion of too large a mouth prop, but more commonly from separating the jaws too widely with a gag, such as Mason's or Fergusson's. Naturally, the condition occurs more frequently in extracting molar teeth than those in the front of the mouth, as the operator requires the mouth to be more widely opened. Again, it occurs much more frequently when a general anæsthetic has been used, because then the patient cannot protest as he would do, if conscious, against the excessive opening of his mouth. Patients have claimed and been awarded heavy damages for this trifling accident, and it is a rule for students in my clinic that, if at the completion of an operation the patient's mouth is not closed, the operator shall push up the chin and see that the teeth in the opposite jaws come in contact, before the patient recovers consciousness. A qualified practitioner, who is so careless of the possibilities attending the operation of extraction as to let a patient recover consciousness with his mandible dislocated, merits only a half-hearted sympathy in any difficulties in which he may subsequently find himself.

The dislocation may be unilateral or bilateral, perhaps more commonly the latter. The treatment, especially if the patient is still under the influence of a general anæsthetic, is simple, and consists in placing the pulps of the thumbs on the mandibular molar teeth and whilst pressing downwards and backwards with them, pulling up the chin with the fingers placed under it. It is the teaching of "books" that a four-tailed bandage should then be applied and the use of the jaws restricted for a week or two. I would not care to say how many times I have seen dislocation occur during the extraction of teeth, and in no case have I ever done anything more than reduce the dislocation. It is one of those things that there is no call for the operator to enlighten his patient upon, either from a moral or a practical point of view. Certainly the patient is no better off for having had his jaw dislocated, but he is

certainly none the worse, except perhaps in one case in a thousand, and so "least said, soonest mended."

Inability to separate the jaws may arise from many causes and adds greatly to the difficulties and even the risks of extraction, especially when the tooth to be removed is at the back of the mouth. These cases are usually better operated on under a general anæsthetic; but it cannot be too strongly impressed upon the dental surgeon that, before operating, he must make a definite diagnosis and, especially if the cause of the trismus is acute inflammation, must estimate its extent and recognise the possibility of a tracheotomy or laryngotomy being required at a moment's notice.

In those cases where there is a difficulty in opening the mouth, nitrous oxide may be a most dangerous anæsthetic, and more than one death has occurred from its misuse. Personally, I use ethyl chloride with plenty of air as the routine anæsthetic in these cases, and, if necessary, prolong the anæsthesia with a little ether. The C-E mixture is also appropriate, as it is non-asphyxiating, but then the patient ought to be recumbent, and the necessity for this position makes it inconvenient and introduces other risks. After the patient is anæsthetised, the jaws can be separated more or less by means of a wedge gag, unless the limitation of movement is due to changes in the joint itself, such as ankylosis or osteophytic outgrowths. The separation can then be increased by the carefully regulated action of Fergusson's gag, sufficiently to make an examination of the teeth and to decide which one is to be sacrificed. No time should be lost in coming to a definite decision, and then the tooth must be removed with forceps or elevator, as the case requires. It is, however, often inadvisable to open the mouth sufficiently to be able to apply forceps, and then the elevator must be used.

Although tonic contraction of the muscles of mastication, especially of the masseter, is frequently mentioned as a cause of difficulty in opening the mouth, I have never to my knowledge seen it in the hundreds of cases that have come under my notice.

Inability to move the joint may, however, occur as a sequel to the operation of extraction, there having been no evidence of it before. This may be due in the first place to swelling and to pain, and during this period of limited movement, organisation of inflammatory products and cicatrisation may take place in and around the mandibular attachments of the masseter and internal pterygoid muscles, leading to chronic inability to separate the jaws more than, perhaps, a quarter of an inch. This is an accident particularly liable to occur after removal of impacted third mandibular molars, so that from the very first, care must be

taken that the patient's jaws are separated every day to their full extent. I have, however, seen it occur in two cases following the extraction of normally placed third mandibular molars, where an analgesic had been injected.

Treatment. A diagnosis having been made, the adhesions must be broken down. This is a somewhat painful procedure, and in the case of a neurotic person, a general anæsthetic such as nitrous oxide should be administered. A screw-wedge gag should be inserted, and when sufficient space has been obtained, a Fergusson's gag, which is more easily controlled, may be substituted for it. The simpler the means, however, the better, and most cases can be treated in the following way. Standing somewhat in front of the patient, the operator asks him to separate the jaws as widely as possible and then places the tips of the fore- and middle fingers of each hand on the tops of the front mandibular teeth, at the same time placing the tips of the thumbs against the cutting edges of the maxillary incisors. The surgeon at first gently, then more and more forcibly, flexes his fingers, until the jaws are fully separated. During this process, one can often hear quite plainly the stretching and snapping of the adhesions. The patient is then given instructions to open the mouth to the fullest extent two or three times daily for the next few days, and to give the muscles healthy exercise by thorough mastication.

Necrosis of the alveolus may follow tooth extraction. On a small scale it is not uncommon, small necrosed splinters being thrown off during the process of healing. This occurs more frequently when several contiguous roots have been removed.

Sequestra on a larger scale may result from the fracture of septa between roots, and may give rise to a considerable amount of discomfort and pain, whilst the contraction of the gum during the process of healing often imprisons them, so that they have to be released. As in the case where a spicule of alveolus projects from the gum, the patient usually returns, feeling certain that a root has been left in. A great deal of discomfort to the patient and of annoyance to the dentist can be avoided, if at the end of the operation he carefully feels with his finger for, and removes any pieces of alveolus that are loose or, if fixed, are sharp and unduly projecting. Thus the chance of hæmorrhage will be lessened, healing will occur more rapidly, and probably painlessly, and the alveolus will be more even and will more readily tolerate the pressure of dentures, results that will be more certainly obtained if the alveolus is firmly compressed between the finger and thumb, as the last step in the operation.

The bone of the alveolus, especially of the maxilla, is remark-

ably tolerant of injury, and in the majority of cases the wound caused by an extraction heals up by granulation without any trouble, even in the least hygienic of mouths. Occasionally, however, infection of the socket occurs, leading to superficial necrosis of its whole surface, the bone losing its pink appearance and becoming whitish, then yellowish grey, and finally dark grey in colour. The necrosis is preceded by a localised infective osteomyelitis, causing a variable amount of pain, which may sometimes be excruciating, especially in a patient already worn out by nights of suffering. It is most likely to occur when the vitality of the bone has been lowered by bruising and laceration during a difficult extraction, especially if the compact bone of the mandible has been encroached upon.

For some reason or other, the first explanation of this condition that occurs, not only to the lay and medical mind, but even to the dental, is "dirty instruments." It is a truth, demonstrated daily in hospital and private practice, that the average dental practitioner has not an adequate conception of what modern surgical cleanliness means, and this statement applies not only to his methods of extraction, but to his operative work in general. In spite of this, however, it is not necessary to think first and foremost of "dirty instruments" to explain these cases of infection. Even when the instruments are carefully sterilised, there are millions of bacteria around the neck of the tooth, which are forced into the tissues by the blades of the forceps; whilst after the tooth is extracted, the open lacerated wound is especially liable to infection from the mouth. No better dressing than a blood clot could be applied, and efforts should be made by mouthwashes and sprays to keep it aseptic. It is partly for this reason that I disapprove of syringing out the socket, and think it should only be done in exceptional cases, as, for instance, after the extraction of an impacted third molar. The necrosed wall of the socket very rarely separates off, but is removed by a process of caries, and the wound after some delay heals over. Clinically, this condition is of importance owing to the severe pain that may accompany it. The treatment will be considered under pain following extraction.

Another factor in the production of necrosis is the prevalent use, or rather misuse, of hypodermic injections for the production of analgesia. Surgeons who have had a large experience of injection analgesia tell me that, on the average, operation wounds after using an analgesic do not heal so quickly nor so certainly as they do when either a general anæsthetic has been used or none at all.

This applies to parts involving soft tissues only, and one occasionally finds that even in such favourable circumstances

as these, the wound opens out in a week or ten days, without any evidence of sepsis—a result simply of lowered vitality induced by the injection. This being so in soft tissues and under aseptic conditions, it is not to be wondered at that delayed healing and even necrosis and sloughing should occur, when the hypodermic injection is intended to render bone as well as soft parts analgesic, and when the operation is performed in a locality, where it is next to impossible to maintain asepsis.

In dental extractions, however, there are at least three other factors to be considered. Firstly, there is the choice of the analgesic agent, and there is abundant clinical and experimental evidence that some alkaloidal salts in concentrations suitable for use are *per se* more liable to produce necrosis and sloughing than others. Intimately associated with the choice of the analgesic is the question of its combination with such powerful local vaso-constrictors as suprarenal extract. The third factor is the syringe. The one thing that has contributed more than any other within the last few years to the success and certainty with which dental hypodermic analgesia can be induced, has been the introduction of powerful syringes, by means of which the operator can now drive his drug deeply into the bone. These powerful syringes have also largely contributed to the number of undesirable sequelæ and to their seriousness. I do not know under what pressure the liquid leaves the syringe, but that it is considerable may be gathered from the mechanical devices that have been introduced from time to time to lessen the bruising of the operator's hand owing to the pressure which he exerts, and from the substitution of all-metal syringes for those with glass barrels, owing to the bursting of the latter.

Another factor is the rate at which the injection is made, and it is appalling to see the equanimity with which some operators will empty a syringe of fluid into the gum, pericementum, and bone of their squirming victims in the space of half-a-minute. It is generally recognised that for the injection to be successful, considerable blanching of the operation area must be brought about. How many surgeons remember, even if they ever troubled to know, that the fluid is injected into the connective tissue spaces, and that the local ischæmia is caused, apart from any vaso-constrictor action the fluid may possess, by the pressure exerted on the walls of the capillaries and even larger vessels by the fluid in the tissue around them driving the blood (and lymph) out of the part! It is difficult to believe that a fluid injected rapidly and under great pressure into cellular tissues can do other than utterly lacerate them and reduce their vitality and power of recovery to the lowest ebb.

Again, a large proportion of teeth that are extracted are

affected with gingivitis, pyorrhœa alveolaris, or acute or chronic (infective) pericementitis. Consequently, there is a danger of the injected fluid not only driving out the blood and lymph, but also dispersing pathogenic organisms into the tissues and even into the general circulation.

I know that many dentists consider that there are no conditions, general or local, to contra-indicate the production of analgesia by injection, and they tell me that they have never had any unfavourable results. I readily admit that the proportion of cases is very small in which there are untoward sequelæ, but I contend that if dentists would pick and choose their cases for injection with a little more discrimination, these sequelæ would be much fewer or even altogether unknown. Nothing would induce me to inject where there was acute inflammation present, and only in exceptional cases would I do so where there were abscesses, with or without a sinus. Again, the best results are obtained when the tooth or root is surrounded by thick, firm muco-periosteum. Hence, if the age, temperament, and general health of the patient are also taken into consideration, there are few cases in my opinion suitable for injection. In addition, if the precautions taken are such as I consider necessary, the time consumed would be sufficient for doing two or three "gas" cases. Besides the saving of time by using nitrous oxide, the patient can be certain of a painless operation and has the advantage of not knowing what is happening, while the dentist has greater freedom in operating through not having to consider his patient's feelings, and the chances of undesirable sequelæ are reduced to a minimum.

A number of the undesirable sequelæ of hypodermic analgesia in dental practice have come under my notice, and I am convinced that the rapidity with which the injection is made is an important factor in their causation. To minimise the risks of after-pain, sloughing, and necrosis, *the fluid must be injected slowly*. Personally I tell the patient beforehand that except for the prick of the needle, the injection to give the best results must be absolutely painless, and at the first suspicion of discomfort, he is slowly to raise his hand to warn me, and I then cease pressure for some moments and gradually apply it again. Hence it usually takes from five to ten minutes to inject the tissues properly for an average tooth, and the fluid has a chance to find its way along, without ruthlessly tearing up everything in its course. It may be interesting and instructive to relate some of the cases that have come under my notice, although it is not intended to suggest that the injection was necessarily the cause of the disastrous results, as the preceding pathological conditions were in many cases unknown or only partially known to me.

1. A L.D.S., who used to pay periodical visits to a village at a distance from his practice, and who used to extract a whole mouthful of teeth at a sitting, gained such a local reputation from the trail of swollen faces, sore gums, and necrosis he left behind him that he had to relinquish the practice for want of patients.

2. A man aged twenty was referred to me by a surgical colleague with the history that having pain in the first mandibular left premolar, he had applied for relief to a dentist, who visited his township periodically. The dentist injected something into the gum and the tooth was removed painlessly. Some hours later, the socket began to ache badly and this continued for some days and then subsided. Swelling supervened, with a considerable flow of pus, and the wound did not heal. When I saw the patient three months later, there was considerable thickening of the bone, the gum was engorged and bathed in pus, and bare bone could be seen. Further examination showed that there was a large sequestrum, and upon turning it out with an elevator, it was seen to consist of the whole thickness of the mandible and to be about an inch in length. Fortunately, a shell of new bone had formed, so that the continuity of the mandible was intact. Instructions for further treatment were given, and I did not see the patient again.

3. A boy of seventeen went to an unregistered practitioner to be relieved of an aching first right maxillary molar. By the courtesy of a dental colleague, I saw him three weeks afterwards, when a large area of the right side of the hard palate was absolutely denuded of muco-periosteum, the bone being dark grey in colour. The three empty sockets stood out prominently, and on the facial side the bone was bare and black, well up on to the root of the malar process. Subsequent history unknown.

4. A lady journalist suffered from severe neuralgia, and her dentist attempted to extract the isolated carious third right mandibular molar after injecting a proprietary preparation of cocaine. The distal root fractured half way and was allowed to remain. The local pain being severe, the patient visited another dentist in a different town, who again injected something and removed the root. The pain, far from being relieved, was aggravated. The patient took to her bed and her medical attendant relieved the pain by morphia. After being confined to the house for a fortnight, she was able to resume her duties, although by no means well. The pain in the socket still continued and I saw her in consultation with her dentist. Examination revealed the slightly damaged socket surrounded by about one-eighth of an inch of bare, dark-coloured bone, from which the gum had disappeared. There was practically no pus. Owing to the nervousness of the patient, who complained that the socket was very painful to touch, it was at first somewhat difficult to get it syringed out, first with strong phenol sodique, and then with warm peroxide of hydrogen. The socket was then gently dried with wisps of absorbent wool, and carefully swabbed over twice with pure carbolic acid on a dressed probe, the second time very thoroughly. This almost at once relieved the pain, and in the course of a couple of months the socket completely healed, without any appreciable bone being separated off.

5. A near relation of a dental surgeon had several roots on each side of the mandible, which it was decided to remove. The dentist urged her to have a general anæsthetic, but she refused, so a proprietary preparation of cocaine was injected and the roots removed painlessly. There was great alarm two or three days afterwards, when it was discovered that the gum on the right side was quite black. The patient came into town, and upon examination the gum in the molar region on both lingual and facial sides, as far as the reflexion on the cheek and floor of the mouth, was quite black and shining, and there was pus in the empty sockets. A streak of blackness spread up on to the soft palate, where it widened out into a slightly irregular area, about the size of a sixpence. Anteriorly, there were isolated patches of blackness along the lingual side of the alveolus extending beyond the middle line. The gum in the molar region was quite insensitive, but in the other parts sensation was only slightly

impaired. The sockets were syringed out with peroxide of hydrogen, and the assiduous use of antiseptic mouthwashes enjoined. The blackness disappeared and sensation returned without sloughing, except that a minute superficial ulcer formed in the centre of the patch on the soft palate, and there was more than the usual amount of discharge from the molar sockets and gum, and healing was somewhat delayed.

I have seen a number of cases such as the following :—

6. A young lady went to a dentist in the evening and asked him to extract a first maxillary molar, which was aching badly. Examination showed that an acute suppurative process was beginning, and he strongly advised her to have nitrous oxide. She, however, insisted on having an injection, and rather than lose the patient, he complied with her wish. He injected a proprietary solution of cocaine very carefully, and the patient had the satisfaction of being able to say immediately after the tooth was removed that she was right after all, as the operation had been practically painless. She, however, had him out of bed at 7 A.M. next morning (Sunday), saying that the pain had become so severe that she had not been able to sleep. The socket was syringed out and the patient reassured, but she came back and spoilt his afternoon, and again in the evening she implored him to relieve the pain. This sort of thing went on for the next two days, and in desperation my advice was sought, just when a turn for the better was at hand. In some of these cases, the pain has been so severe, so constant, and so wearing that it has been necessary to give morphia to induce sleep.

Cases of neuralgia, sometimes associated with definitely localised painful spots in the gums, are much more common than when a general anæsthetic has been used. Several of these cases, after dragging on for months, have come into my hands, and have been relieved only by operative measures.

Treatment lies in the application of general principles. The socket must be kept as clean as possible by mouthwashes, sprays, or flushings with a syringe, and the best agent to use is peroxide of hydrogen (10 vols.), which can be diluted with two or three times its bulk of hot water. It is far more important to use whatever drug is chosen frequently even in small amounts than a large quantity once or twice a day. If a sequestrum separates off, care must be taken to remove it at once, as it is apt to be retained by the soft parts and to promote suppuration and delay healing. If sharp edges or points are projecting and irritating the gum, tongue, or cheek, they may be broken off with excising forceps or smoothed with a stone or preferably with a large coarse-cut bur. Patience must then be exercised until the necrosed bone is thrown off as a sequestrum or removed by caries or absorption, when the soft parts rapidly heal up. A certain amount of pain and neuralgia may be experienced from the accompanying osteitis and periostitis, especially in the earlier stages, and may require treatment. The general health of the patient must be attended to and the bowels in particular regulated.

Undue laceration of the gums varies greatly in degree, and while it may be the result of gross carelessness, extensive lacera-

tion may occur in the hands of the most skilful. It is much more common in the mandible than in the maxilla, and in the latter it occurs most commonly in extracting the canine teeth. The laceration may result from opening the forceps too widely and so including gum in their grasp, and then tearing away tooth and gum together; or it may result from repeated futile efforts at grasping the tooth, the forceps slipping at each attempt, thus causing a mangling of the gum edge. It may also result from a loosened root or an attached piece of alveolus tearing through the gum, or from the slipping of an elevator. Another cause is an abnormally strong attachment of the gum margin to the pericementum at the neck of the tooth, the result of chronic inflammation, and most typically seen on the distal side of the third mandibular molar. Again, quite extensive stripping of the muco-periosteum from the alveolus may occur without any special difficulty in the operation, and in spite of every effort to prevent it on the part of the operator. In the few cases in which I have seen it happen, there has apparently been a very feeble attachment of the muco-periosteum to the bone. In one such case, whilst a dentist was extracting all the mandibular teeth of a young man, the gum stripped off the alveolus on both lingual and facial sides, as each molar was removed. When all the teeth had been extracted, the whole alveolus was lying bare with the muco-periosteum in folds along its reflexion on to the cheek and the floor of the mouth. A short household needle was procured, softened in a flame, bent to a suitable curvature, threaded with strong cotton, and then the detached flaps were held in position by several interrupted sutures passed through them close to their edges and tied over the alveolus. Under careful antisepsis, healing occurred in the ordinary way, as though nothing untoward had happened. In another case of extraction of practically all the teeth from the maxilla, whilst a very firmly implanted canine was being removed, the gum split up over the length of the root, leaving a loose flap on the distal side. A single silk suture was passed through the gum margin so as to bring the edges of the tear into apposition. The wound healed comfortably and quickly, the stitch being removed on the eighth day.

The prevention of laceration of the gums lies largely in the adoption of a proper technique; for then the forceps do not so frequently slip off the tooth, and the gums are well supported by the firm pressure of the left forefinger and thumb. If there is undue attachment of the tooth to the gum, it is a great mistake to pull half-heartedly on the tooth, as this may cause a severe tear, and even if the gum stretches instead of tearing, there may be considerable submucous laceration, leading later on to pain

and swelling. In such a case any attempt to remove the loosened tooth should be desisted from ; but if there are other teeth to be extracted, it is frequently better to remove them first. When this has been done, the attached tooth can be released by pulling gently on it with the fingers or with a pair of forceps, whilst the stretched gum is severed **close to the tooth** with a sharp knife or preferably with a pair of Quinby's curved gum scissors (fig. 11). This proceeding is not very painful, even if it is done after the patient has recovered consciousness. If the attachment of the gum to the tooth is not very strong, it can often be severed, without any damage being done, by firmly grasping the gum with the left forefinger and thumb, and whilst the tooth is still held by the forceps, giving it a short, sharp tug. Another way, often applicable to third mandibular molars, is to hold the tooth firmly in the socket with the forefinger of the left hand and then detach the gum by means of a sharp, angled elevator applied firmly to the neck of the tooth.

When the gum has been lacerated, the operator must use his judgment whether to leave it alone, suture it, or cut it away. If the torn part has a broad attachment and tends to lie well in place, it may usually be left alone. If, however, it tends to fall aside, leaving bare bone exposed, a single stitch will often hold it in place and render the process of repair much quicker and more comfortable to the patient. If on the other hand, the torn tag is more of the nature of a string, or if it has been badly bruised, or if the tissue is friable from acute inflammation, it is often best to remove it, as it is apt to cause annoyance by its presence, and also apt to slough, and then the odour and taste may be most distressing to the patient and his friends. The assiduous use of mouthwashes, especially hydrogen peroxide, must be enjoined on the patient, and the bowels must be attended to.

Laceration of the lips may occur, usually of the lower one, during the extraction of maxillary teeth, especially the molars. This is almost always due to the absurd practice of attempting to follow the orthodox teaching to "first rock the tooth inwards" or advice to that effect. The lip becomes compressed between the handles of the forceps and the mandibular teeth. Again, I have more than once seen the edge of the upper and of the lower lip included in the grasp of the forceps—inexcusable carelessness ; for the lips should be displaced well out of the way with the left hand. The lips may be badly bruised from want of care in inserting a mouth-opener ; for the lower one in particular tends to get pushed over the mandibular teeth and gets crushed between them and the mouth-opener or gag. Laceration may also be due to the mouth not being sufficiently open,

and in an anæsthetic case the largest prop that will allow the patient to breathe comfortably should be chosen. Using forceps of insufficient curvature is also assigned as a cause, and in a very general sense this is true. With the angle, however, which the upper forceps recommended in these pages have, it is perfectly easy to reach even the third molar, and if in doing so the lip is bruised, it is due to improper technique, and not to the forceps.

It should be remembered that one occasionally meets with a patient in whom very slight pressure may cause severe bruises. I have met with two cases in private practice, both in ladies over fifty. In one I extracted a right mandibular molar under nitrous oxide, and where my fingers had gripped the lower border of the mandible a severe bruise developed in which an abscess formed and had to be opened. The patient told me afterwards that she was never without a bruise somewhere on her body. Had I known it beforehand, I would not have gripped the mandible at all.

In the other case, I administered nitrous oxide and ether for a dentist to extract a number of roots and loose teeth. In the evening he was called to see the patient as her face was very much bruised and the lower lip was black and greatly swollen, whilst the gums were oozing. In addition there was a definite bruise indicating where the pneumatic pad of the facepiece had pressed on the bridge and sides of the nose. The bruises disappeared in due course without any complication.

Laceration of the tongue may occur, but it too is an impossibility if the technique herein advocated is adhered to. The only cases in which I have seen it occur have been during the extraction of mandibular molars, when the operator has made no attempt to keep the tongue right away from the site of the operation with the left forefinger or thumb, using these instead to drive the blades of the forceps into the tissues, thus letting the edge of the tongue cover the lingual sides of the teeth and become included in the grasp of the forceps.

Injury to nerves in the vicinity may occur, but the only one of clinical importance is the mandibular nerve, which may be damaged in removing the premolars and the molars (especially the third). If a mandible, from which the bone has been removed to expose the relationship of the mandibular canal to the roots of these teeth, is examined, one cannot but wonder that the canal is not oftener implicated in pathological conditions associated with these roots. Several interesting cases of bruising or of actual tearing through of the nerve have been recorded, in connection with the removal of the third molar. In a case recorded by Mr Henry Sewill, the root of the third molar pre-

sented a foramen, through which the mandibular nerve had evidently passed. I have only met with one case of this nature, and it was recorded in the *Transactions of the Odonto-Chirurgical Society for 1901-02*. Since the vessels accompany the nerve, the nerve lesion is sometimes associated with severe hæmorrhage.

The mandibular nerve supplies sensation to the mandibular teeth, the mandibular gums and contiguous mucous membrane, and to the skin of the chin from the lower lip to the inferior border of the mandible and backwards a little beyond the commissure of the lips. The injury usually manifests itself at once to the patient by loss of sensation in the parts supplied. He puts his hand to his lip and asks what has been done to it as it feels swollen, and he cannot feel that he is touching it. Again, when rinsing out the mouth, the contact of the glass is not felt on the side of the injury. There is seldom any marked pain at the site of the lesion. There is no special treatment to be adopted, and gradual recovery almost invariably occurs in the course of two or three months; but the paralysis may be of long duration or even permanent. Injury to the nerve in connection with the extraction of the first and second molars seems to be very rare; but several cases are on record in connection with operations on the premolars.

The only case in my own experience occurred recently. A medical man over sixty years of age and apparently edentulous, gradually developed a swelling of the alveolus in the region of the first premolar. Some months after its first appearance, his dentist passed a sharp probe through the gum and detected enamel. An analgesic was injected, the gum incised, and the crown of the tooth having been laid bare, an attempt was made to extract it, but only the crown was removed. Persistent and severe neuralgia followed, and I was asked to remove the root some months after the first attempt. Novocain was injected, and the gum incised and pushed aside, so as to get a view of the root. Forceps were applied to the edge of the socket, and after some difficulty the root was loosened; but attempts to remove it simply resulted in chipping pieces off it. An elevator was therefore applied to the distal side of the root, and it was only after gouging away some bone that it was dislodged, and the difficulty in removal was then seen to have been caused by a spherical mass of cementum at the end of the root. There was a good deal of local pain for some days, the wound took several weeks to heal up, and during this time, and for several weeks afterwards, there was marked but not complete loss of sensibility in the region supplied by the mental nerve.

Injury to vessels resulting in excessive hæmorrhage is, con-

sidering all the circumstances, remarkably rare. It should be a rule that the hæmorrhage occurring at the time of the operation should have ceased before the patient is allowed to leave, and this entails no great hardship, as it almost invariably stops within a few minutes. In fact, excessive primary hæmorrhage after tooth extraction is so rare as to require little more than mention.

It has been already pointed out that constant rinsing out of the mouth favours hæmorrhage, and that the patient should simply spit out when necessary, and when the hæmorrhage has ceased, should rinse the mouth out to make it comfortable. The bleeding is almost always capillary in nature, and local conditions may aggravate it, for instance, when there is acute inflammation which has led to an acute or subacute dento-alveolar abscess, or in chronically inflamed, congested gums. Very rarely the hæmorrhage may come from an arteriole or venule, which has been partially torn through, or which has, owing to chronic inflammatory changes in its coats, been unable sufficiently to contract and retract to allow of its lumen becoming occluded.

Primary as well as other forms of hæmorrhage may be due to constitutional conditions such as hæmophilia, purpura, cardiac lesions, jaundice, chronic interstitial nephritis, menstruation. **Hæmophilia** is the most important. It is a condition in which there is a strong predisposition to excessive and intractable hæmorrhage, often from very slight injuries. It is rare, but by no means unknown in females. It is markedly hereditary, the peculiarity being that the non-hæmophilic females in the family-tree transmit the affection to the males. It may early show itself by the excessive bruises (subcutaneous hæmorrhage) that may result from trifling injury, by swelling of the joints from hæmorrhage into them, and by hæmorrhage from mucous membranes, especially epistaxis. One must not, however, diagnose hæmophilia hastily; for this serious affection is fortunately very rare. The nature of the defect is at present unknown; but it is admittedly associated with the blood itself and not with the vessel walls, which are apparently normal, histologically and functionally. When a patient presents with a history of excessive hæmorrhage following injury, the dentist must not perform any operation that will lead to hæmorrhage, until a most careful investigation has been made; and if the patient is really hæmophilic, he must have very grave reasons to justify the extraction of even a loose tooth or root. Apart from hæmophilia, however, one meets with patients who bleed excessively, and in these cases not more than one or two teeth should be extracted at one sitting, and care should be taken to perform the operation with as little laceration and bruising as possible.

I have occasionally seen very excessive hæmorrhage imme-

diately follow the extraction of a tooth. For instance, a student, who was extracting a lot of roots, encountered difficulty with the left maxillary central incisor, and as the patient was recovering from the anæsthetic and it was the last tooth, I took the forceps and removed the root. Immediately there was a gush of blood from the socket of sufficient force to escape the mouth and fall on the patient's chest. Firm, digital compression reduced the flow to a rapid dropping, which ceased altogether in a minute or two. The patient was kept sitting in a chair for half-an-hour, and then allowed to go after receiving instructions what to do in case of a recurrence.

In another case in private, a dentist, who was not an expert operator, was removing several roots and the third left maxillary molar. Some mangling of the soft parts around the tuberosity occurred, and there was smart arterial hæmorrhage, so that care was required to prevent the blood reaching the air-passages. In this case also, firm digital pressure was effectual in permanently arresting the flow, which did not recur.

Reactionary (intermediate) hæmorrhage, or that which occurs after the cessation of the primary hæmorrhage and within twenty-four hours of it, is the most common form of hæmorrhage with which the dental surgeon has to deal, and it usually comes on in the evening or night following the operation.

Secondary hæmorrhage, or that occurring about a week after the operation and due to infection, is extremely rare. I have met with only one case, that of a lady fifty-five years of age, for whom I extracted under nitrous oxide a very badly decayed right maxillary canine, which had been the seat of constantly recurring, subacute inflammation. Nothing abnormal occurred until five days after the operation, when after lunch, hæmorrhage set in from the socket. In the evening I was telephoned for, as the bleeding so far from responding to household remedies was becoming more severe. Upon examination there was quite brisk capillary hæmorrhage. The socket was vigorously syringed out with peroxide of hydrogen (10 vols.) and the hæmorrhage controlled by plugging.

It is not at all unusual, especially when several teeth have been removed, for slight hæmorrhage to occur during the night following the operation, when the patient retires to rest, the warmth and recumbent position favouring it. Therefore, if a patient gives a history of bleeding readily, or if he is over-anxious and inquires what to do in case bleeding comes on, simple instructions should be given which, if carried out, may save the dentist being called out late at night for what may be really a trivial hæmorrhage. I give the general instructions that are detailed later on, and in addition direct that pressure shall be applied to the bleeding

spot. If there has been a general clearance, a small handkerchief or piece of rag can be sterilised by boiling for fifteen minutes, and then folded so as to be about six inches long and an inch wide. This roll is put on the top of the alveolus and firm pressure kept up with the mandible. In the case of one or two teeth, a piece of cotton wool can be rolled firmly into a ball large enough, when placed over the empty socket and the jaws clenched, to prevent the remaining teeth coming into contact. The pressure must be kept up continuously for at least half-an-hour, and longer if necessary.

Treatment. Most people dislike the sight of blood, and even a slight hæmorrhage may occasion great alarm to the patient and his friends. Consequently, the first thing to do when called upon to treat a case is to show no concern oneself, and the more severe the hæmorrhage, the more the need to allay the alarm of the patient by one's own behaviour, whilst quickly but unostentatiously making preparations for its arrest. The patient should be made to sit up in a cool room, in which the windows can, if necessary, be opened, and only allowed to spit out the blood, and not to wash out the mouth with hot water. The mouth must now be examined, and a blood clot will probably indicate the site of the hæmorrhage. This must be pulled away with tweezers or rubbed off with a small sterile sponge or piece of gauze. The mouth can then be quickly washed out with cold or cool water and the sockets examined. The bleeding socket or sockets having been located, one should try to find out whether the hæmorrhage is from the gum or from the bony socket. To this end the socket may be vigorously syringed out and quickly dried with a cone of cotton wool held in tweezers ; or the hæmorrhage may be momentarily reduced by plugging the socket with a cone of wool dipped in suprarenal extract 1-1000, and exerting pressure. The bleeding is usually a capillary ooze more or less from the whole surface of the socket ; but it may be from a localised point in the soft parts. In the latter case, the bleeding spot may be firmly compressed for a few minutes with the points of a pair of artery forceps. This, however, is usually easier said than done, owing to the difficulty in applying them, even when curved. I have only used artery forceps once, in the case of a jaundiced patient of about fifty, whose loose mandibular incisors had been removed, and where there was a definite bleeding spot in the chronically inflamed gums, which had not responded to plugging. Firm pressure of the alveolus between the thumb and finger for some minutes may sometimes suffice, especially when the alveolar plates have not been firmly compressed at the time of the extraction. Again, hæmorrhage from the gum may be arrested by pressure exerted by a silk suture passed with a curved

needle, first through the facial gum flap and then through the lingual, and tied. One suture is usually sufficient, but if the wound is large, two or more may be needed, and they can be left for a week if necessary and then cut and removed.

Thus, whether the hæmorrhage is from the gum or from the bony socket, **pressure with or without the addition of a styptic should be the routine treatment**, and I have never met with a case where it has not been efficient, when properly applied. The object in view is to plug the socket or sockets firmly, and as the operation may be painful, the patient should be told so and asked to co-operate, and in return the dentist should take care to do his part so effectively that the plugging does not need to be done a second time. A glass slab, a solution of one of the gum-resins (mastic, sandarac, copal) of a syrupy consistency, some finely powdered alum, a spatula, a round-ended plastic instrument or strong probe, a strong pair of conveying forceps, a water syringe, and some cotton wool are required. The wool may be absorbent or non-absorbent, for in any case the treatment to which it is subjected renders it non-absorbent. Each socket should be plugged separately, so that in the maxilla a molar socket may require three plugs, and in the mandible two.

Method. A quantity of cotton wool is taken, which is deemed more than sufficient to fill the socket under consideration, and it is teased out in the fingers so as to make a rope of uniform diameter, and of sufficient tenuity to be carried readily to the apex of the socket. Several drops of the gum solution are placed in a row on the glass slab and the wool dropped on them. There should not be any excess of the gum solution, or later it will squeeze out into the patient's mouth and cause discomfort. Some powdered alum is spread out on the slab, the wool dropped on to it with the tweezers and lightly rolled in it, so that a quantity of it adheres. A number of rolls equal to the number of sockets to be plugged are thus prepared. Finally, a larger piece of wool is firmly rolled up without any frayed edges, to make a biting pad over all—one the size of the distal half of the thumb is usually sufficient.

If during these preparations the socket (or sockets) has been temporarily plugged with suprarenal extract, the hæmorrhage by this time may be considerably lessened. The temporary plug, if present, should be removed, and the socket vigorously syringed out with cold antiseptic solution to remove all blood clot. The appropriate wool rope is now taken in the strong tweezers by one end and that end carried to the apex of the socket, where it is held by the plastic instrument or probe, whilst a fresh hold of the wool lower down is obtained with the forceps and thus another portion carried up. This is continued until the socket is firmly

and completely packed, so that part of the wool projects beyond. It should be done so rapidly and so accurately as to take only a few seconds. The large wool pad is now placed over the sockets and the patient instructed to bite firmly on it. If he can be trusted not to separate his teeth in doing so, he may now be allowed to wash out his mouth to free it of any blood or gum solution which may have squeezed out. Directions are generally given that a four-tailed bandage should be firmly applied; but this to be effective is a source of not a little discomfort to the patient, and is only necessary on the rarest occasions. The dentist should remain until he is quite satisfied that the hæmorrhage has ceased, and personally I let the patient sit in a low chair and tell him to rest his elbow on his knee and to press his chin into the palm of his hand, whilst he reads a book or newspaper. If he is in bed, he can also assume this attitude. In a quarter of an hour the lips are retracted, whilst the patient still keeps his teeth clenched, and the wool pad examined. If the plugging has been effective, it should be practically unstained, and if the patient has rinsed out the mouth immediately after the pad was inserted, any saliva he now expectorates into a white basin should be clear, or practically clear, of blood.

There may, however, be still slight evidence of bleeding, and in this case nothing should be done, but an examination made again in a quarter of an hour. If the plugging has not been effective, the large plug will be stained with blood. It should be removed, and the deep plug rapidly examined round the margins to determine from which socket the bleeding is still proceeding. If deemed necessary, the plug must be removed and a more effective one inserted.

There is considerable difference of opinion as to when the plugs should be removed. Personally, I do not think it matters, provided they are left in long enough to do what is required, and inasmuch as no harm comes from retaining them for several days, or even from leaving them until they are extruded in the process of repair, it is better to leave them alone for two or three days—the frequent use of a mouthwash will prevent any unpleasantness from decomposition.

The **general instructions** are also important. The object in view is to keep the blood pressure in the gums as low as possible. Consequently, the patient should be in a cool room, and either sitting or standing, with the clothing round the neck loosened. The parts must be kept at rest, so the patient should pass the time reading rather than talking. Should any nourishment be required, it should be administered cold and in a fluid state. It does not seem to be sufficiently well known that even with entire dentures present, there is ample room behind the third molars

and between the various teeth for fluid nourishment to pass to the pharynx, so that tubes of any kind are quite unnecessary and only add to the discomfort of the patient.

It will be seen that reliance is placed mainly upon pressure on the bleeding point for the arrest of hæmorrhage. No harm, however, is done by the use of a styptic in addition, and *alum* is chosen because it is a good styptic, it does not destroy the tissues, and its taste is not unpleasant. Text-books usually advise the use of tannin; but it has no special advantage, and has a very unpleasant taste. *Turpentine* is a very powerful styptic and is harmless, but has an unpleasant taste. It is, however, to be found in most houses and should be remembered. *Perchloride of iron* has been used in the past, but is largely discredited now. It contains a quantity of free acid and is apt to cause sloughing, and although it may control the hæmorrhage at the time, there may be a worse hæmorrhage to treat, when the sloughs separate. Consequently, if it is used (and it is a powerful styptic), care must be taken to use so little that it does not get squeezed out of the woollen cone, when it is compressed in the socket. *Nitrate of silver* is also a powerful styptic, but like the persalts of iron is caustic and apt to be followed by secondary hæmorrhage. *Peroxide of hydrogen* is a good styptic, is not caustic, and is moreover beneficial in being powerfully antiseptic. Preparations of *hamamelis*, *krameria*, *matico*, etc., owe any efficacy they possess to tannin, and it would be better to use that drug itself.

The fact that patients have died from hæmorrhage after tooth extraction indicates that the condition has not received due attention, or that, in some cases, treatment is of no avail. I have never seen a case that did not respond at once to the treatment indicated above, and hence the advice given below is not based on clinical experience and has only the value of "book knowledge." One cannot help feeling that with such a wound as that resulting from the extraction of a tooth or teeth, the dictum should hold true that "no patient should be allowed to die of hæmorrhage." Accordingly, if the first measures fail, something else must be done, and surgical measures will be found to be more efficacious than drugs. Pressure on the bleeding point must still be the first line of defence; but the patient himself should not be trusted to exert the pressure. A four-tailed bandage should be applied, with plenty of wool interposed between it and the skin, over the chin and the occiput, the knots being tightly tied, whilst the patient clenches the jaws as firmly as possible. Then, by standing behind the patient, the common carotid artery on the same side can be compressed with the fingers, against the transverse process of the sixth cervical vertebra.

Should the loss of blood have been considerable, the patient may feel faint or may actually faint. This state being associated with a lowered blood pressure is distinctly favourable to the arrest of hæmorrhage, and although it will be necessary to let the patient lie down, one must be very chary of giving any stimulant, which will only aggravate the seriousness of the situation by increasing the hæmorrhage. One can also take comfort in the knowledge that the greater the hæmorrhage within limits, the greater becomes the coagulability of the blood. By this time skilled help should be called in if possible, so that the responsibility for subsequent treatment may be shared with another.

Patients die from hæmorrhage primarily from an insufficiency of fluid circulating in the vessels, so that death can be prevented by replenishing the vessels by artificial means. Leaving transfusion out of account, there are three ways in which this can be done.

1. Infusion of hot sterile normal saline solution into a vein naturally produces the quickest results ; but great precautions and special knowledge and instruments are required.

2. Hypodermoclysis or the irrigation of loose connective tissue such as that of the abdomen with the fluid, from which it is absorbed into the vessels ; but the objections that have been urged against venous infusion apply with only diminished force to this treatment.

3. One of the chief functions of the rectum is to absorb fluid from its lumen. Consequently, even a layman can keep a patient alive, who is becoming collapsed from capillary hæmorrhage, by administering a hot saline enema, and as the fluid is to be retained, the buttocks should be raised on a pillow and only a small quantity injected, say 8 oz., which can be repeated later on if necessary. Of course the stomach wall is also a great absorbent of water ; but so long as the patient is conscious enough to be able to swallow, he should not be allowed to have any liquid, although the mouth and lips can be moistened by giving him a little ice to suck.

The patient being now free from immediate danger, attention must once more be directed to the wound. The plug can be removed and another inserted very compactly and a change of styptic tried. Probably turpentine will be the best, or the actual cautery may be applied all over the surface of the socket. It must be remembered, however, that the cautery must be barely more than a black heat, or, instead of sealing the vessels, it will cut them like a knife. Should these measures fail, one must consider the question of tying, at least temporarily, the external carotid artery, or in the case of the mandibular sockets, of plugging the mandibular canal.

With regard to **hæmostatics**, I have seen cases in which gallic acid, tannin, and adrenalin have been administered with apparently no beneficial results, although subsequent plugging of the socket was effective. I think that on general principles one should rely very little on internal medication. It is a matter for reflection that so much consideration is given in dental text-books to hæmostatics for the arrest of hæmorrhage. In text-books on other branches of surgery and, as a matter of fact, in surgical practice generally, no importance whatever is attached to them, and it is difficult to understand why they should be of special benefit in dental surgery. As has been pointed out, however, hæmorrhage is very alarming, and fear may so augment cardiac action as to increase the bleeding very markedly. The sedative effect of a small dose of morphia may thus be valuable and $\frac{1}{6}$ gr. of one of the salts of *morphia* may be given hypodermically, better still $\frac{1}{12}$ - $\frac{1}{6}$ gr. of *heroin* may be prescribed, as it presents the advantages without the disadvantages of morphia. *Tannin* and *gallic acid* are often recommended in frequent 5-10 gr. doses, but they are probably valueless (Whitla). *Turpentine* is not only a powerful styptic but a hæmostatic, by causing contraction of arterioles and by increasing the coagulability of the blood. It may irritate the kidneys, so must be used with discrimination. Dose 20m every hour.

The effect of a dose of the *extract of the suprarenal gland* is very short-lived—probably only a few minutes—consequently to be of any use, it would seem to be necessary to infuse it into a vein continuously in a state of great dilution. It is certainly far more useful when applied locally.

Ergot, like adrenalin, causes contraction of the blood vessels, but at the same time the rise in the blood pressure more than compensates for this, and it is probably worse than useless.

Calcium salts, especially the chloride and the more palatable lactate, in doses of 15 grains every two or three hours, increase the coagulability of the blood. In spite, however, of books which tell one what to do in cases where "there is a thin watery blood and no tendency to coagulate," such a pathological state of things is practically or wholly unknown, and want of coagulability is probably never a cause of excessive dental hæmorrhage. The beneficial effect of these two salts of calcium has of recent years been greatly called in question, and for both these reasons they are probably useless as aids to the arrest of dental hæmorrhage.

The subcutaneous injection of *serum* (human or animal) seems to have been of undoubted benefit in some cases of hæmorrhage, especially that associated with hæmophilia.

What should be done in the case of a patient who, before being

operated on, gives the history of a tendency to go on bleeding after tooth extraction? The previous hæmorrhage may have been dependent on general or local causes, and no operation involving severance of blood vessels must be performed, until a full and satisfactory investigation has been made. The appearance of the patient, the history of the case, and a physical examination may indicate a condition of backward pressure from cardiac or pulmonary disease, or inquiry or examination may reveal other general conditions predisposing to hæmorrhage, such as atheroma, chronic interstitial nephritis, diabetes, or albuminuria. Again, especially if the patient is a male, it may possibly be a case of hæmophilia; or if a woman, and of menstruating age, one of the rare cases spoken of as "vicarious menstruation"; or the undue hæmorrhage may simply have been due to too vigorous exercise following the operation, or to the unwise resort to stimulants. Lastly, it may have been due to local causes, such as acute inflammation, chronic gingivitis, excessive laceration of the gums, or neglecting to compress the alveolar border during the operation.

The possible cause having been determined, appropriate treatment should first be carried out if there is no need for the extraction to be done at once. In any case, the mouth should be rendered as clean as possible by brushing, and the use of peroxide of hydrogen enjoined, so as to reduce sepsis to a minimum. If no special cause can be discovered to account for the history of hæmorrhage, calcium lactate may be administered for two or three days before the operation, in 15-gr. doses before meals. If there are a number of teeth or roots to be extracted, it is wiser to extract only one and await the result. If no excessive hæmorrhage ensues, the remainder may be extracted on any subsequent day, special care being taken to lacerate as little as possible. Another important point is to operate in the morning, so that should undue hæmorrhage occur, it may be dealt with during the day. Also, in the case of a patient who, you know, is liable to bleed, it may save trouble to plug at once, and to let him sit quietly for an hour or two before going home—it would be better still to operate in his own home.

Post-operative pain. After the extraction of a tooth, there is naturally a certain amount of discomfort and tenderness, which varies greatly with different temperaments. Considering, however, the number of extractions that are performed, the cases of excessive pain that last for more than an hour or two after the operation are rare.

Some of the causes have been already considered under other headings; but for convenience they may be enumerated here.

- (1) Excessive laceration of gum and bone (pages 115, 130).
- (2) Osteitis and periostitis, which may lead to necrosis (p. 125).
- (3) Injury to a nerve trunk (page 133).
- (4) Fracture of a tooth, part of which has been left in, especially if the pulp or a portion of it remains.
- (5) The presence in the socket of a foreign body, which may lead to excessive suppuration, and over which the soft parts may be contracting, whilst healing is taking place.
- (6) Too rapid healing of the orifice of the socket, leading to retention of discharges.
- (7) Acute infection of the socket.

Pain, delayed healing, and suppuration are more common in connection with mandibular sockets than with maxillary, and this is explained by the poor drainage and the greater tendency for food to lodge in them. When a patient complains of excessive pain following an extraction, the operator may be able at once to fix upon the probable cause from his knowledge of the circumstances of the case ; but if the patient consults another practitioner, there may be some difficulty in diagnosis. The second practitioner should, unless distance and urgency prevent it, refer the patient to the original operator, and in any case do and say nothing that would disparage him. If the dentist consulted was not the operator, he should make inquiries as to the circumstances of the operation, the existence of previous pain or swelling, any difficulty in the extraction, and the subsequent history of the case. In this connection, I wish once more to emphasise the necessity of an operator's telling the patient quite frankly of any piece of root that has been left in or of any other accident, so that if trouble should subsequently arise, the patient may be able to give valuable information to anyone else whom circumstances may compel him to consult.

A careful and gentle examination of the socket must be made, and any evidence of inflammation and swelling of soft parts noticed ; also whether the socket is dry and open or whether the soft parts are closing over it, and whether there is pus or not. After noting all that there is to be seen, it may be necessary to examine further with a probe, and if there is great sensitiveness, the socket should be gently dried with a loose pledget of wool and then as gently swabbed over with a pledget saturated with a *warm* solution of cocaine and adrenalin or of novocain and adrenalin. A blunt probe should be passed all over the walls of the socket to feel for any fractured or loose piece of bone, and for any foreign body such as a piece of enamel, a filling, or food. One may also come across a particularly sensitive spot, usually at the bottom of the socket, which may be a piece of live pulp in a portion of root that has been left in, or the apical nerve. If

there is any doubt as to the presence of a piece of root, it may usually be cleared up by means of a sharp probe. The fractured surface of dentine offers far more resistance to pressure than the most sclerosed bone, on which it is always possible to make a slight impression, which may be accompanied by pain. Again, if the sharp probe is scratched over the surface, it catches slightly on bone, whilst it glides over dentine. Lastly, it may be possible to slip the probe from the dentine into a central canal—proof positive that a bit of root is present. An X-ray examination may also be valuable, but if the fragment of tooth is small, the bone thick, and the light too strong or the exposure of the photographic plate too long, a negative result may be given when, as a matter of fact, a piece of root is present. I have met with several cases of this sort, and consequently, before one accepts the truth of a negative result, one must be satisfied that the circumstances of the examination were suitable for the particular case.

In considering fractured roots, it is useful to remember that the leaving behind of a small piece is far more likely to occur with some roots than with others. Thus, as has been already mentioned, it is very uncommon with the six front teeth and with the third maxillary molars. Of the remaining teeth, it is most likely to occur with the maxillary first premolar and with either of the mandibular premolars. In the case of the molars, both maxillary and mandibular, it is usually a piece of the distal root that is left in.

The **treatment** of pain following extraction will consist in removing the cause if possible, in the application of anodynes and possibly the administration of general sedatives.

When the tooth has been completely removed and the pain is due to laceration of surrounding parts, anodyne and antiseptic washes and applications must be relied upon. Thus the patient can be told to hold mouthfuls of hot phenol lotion (1-60) or hot sodii phenas (1-60) in contact with the wound; or it can be painted over frequently with glycerinum acidi borici, or powdered with orthoform. If the surface of the ulcer is sensitive, and the edges look red and angry, with but little evidence of healing, the whole ulcerated surface should be lightly touched with a caustic such as phenol, silver nitrate, or copper sulphate, which will greatly relieve the pain and promote repair. If the patient is worn out with pain and want of sleep, it may be necessary to administer general sedatives; but this must not be done without full realisation of the responsibilities involved, and probably it will be wiser to confer with the patient's medical attendant, who will be more conversant with his constitution and idiosyncrasies.

In the case of a fractured root, the question will arise whether to attempt its removal or not, and each case must be judged on

its merits. If the portion is a large one, perhaps containing a live pulp, and if the dentist thinks that he can remove it without a great deal of damage to surrounding parts, it is certainly the best treatment to make the attempt. If, however, he has considerable doubt as to the probable success of the operation, he should not attempt it, but should dry out the socket and apply pure phenol to the pulp. One or several applications may be required before the pain finally settles down, and then as healing takes place and the alveolus absorbs, the root becomes more superficial, and in the course of a year or two may project through the gum and can then be readily removed. There is one case in which as a result of experience, I do not now usually make any attempt to complete the removal of the root, and that is where a mandibular premolar is fractured at or beyond the middle of the root; for, although the attempt may be successful, the injury done to the thick compact bone surrounding the socket may actually increase the severity of the pain, for the relief of which the root has been removed.

In the case of a foreign body, all that is usually required is to remove it, and then to syringe out the socket with a warm antiseptic, preferably hydrogen peroxide.

In cases where the soft parts are relatively deep and the bony socket shallow, as occurs in some cases of pyorrhœa, also in cases of considerable excavation of bone from abscess formation, the edges of the wound may heal so much faster than the deep parts as to cause more or less retention of pus, and so may give rise to pain and discomfort. The edges of the wound must be freely separated by means of a probe or knife, the pocket well syringed out with peroxide of hydrogen, and possibly the wound lightly packed with gauze to keep the edges apart so as to allow of free drainage and to encourage healing from the bottom. It is useful to keep two widths of "bicyanide ribbon gauze" for use in the mouth, half-inch and inch, as it is much easier to pack them in than to pack irregular strips cut from a piece of gauze. The bicyanide of mercury and zinc is preferable to other antiseptics such as iodoform, because it is tasteless and keeps sweet for two or three days, if it is necessary to leave the gauze in for so long without dressing the wound.

The state of the patient's health is also an important factor, and in the case of those suffering from chronic debilitating diseases such as chronic nephritis, anæmia, syphilis, and diabetes, particular precautions should be taken to do as little damage as possible in extracting teeth. In the case of hospital nurses and medical students, wounds are from the nature of their duties apt to become infected, and they should take particular precautions to keep the mouth as clean as possible. Attention must be paid to the general health and especially to the bowels.

It has been known as an indisputable fact for many years that the effect of opium or morphia in relieving pain is purely by its action on the cells in the central nervous system, and that it has no effect whatever on peripheral nerves or their end organs. Consequently, it is somewhat disappointing that the bulk of dental surgeons, and even many who hold teaching positions in our schools, still apparently have an unbounded faith in its local action. One cannot conceive that from a trace of morphia acetate sealed into a carious cavity or incorporated in an arsenical preparation for the destruction of the pulp, or from a poppy-head fomentation used in the mouth, or from tr. opii placed on wool in an empty socket, sufficient of the drug can be absorbed into the blood stream to affect the cerebral cells. Some relief may result in the two last cases, but it is due to warmth in the one case, and to the alcohol and the protection afforded by the cotton wool in the other.

Although the operation of extraction of the teeth is one that ordinarily carries with it practically no risk, it cannot be too earnestly urged that **possible danger even to life attends each and every extraction.** Quite apart from the question of ethics, the activity of the public within recent years in taking legal proceedings against surgeons in general and dental surgeons in particular, and the encouraging success that has often most unjustly attended their efforts, should make one careful. All reasonable precautions must be taken before, during, and after the operation to ensure the least risk to all concerned. Thus I have personal knowledge of a case in good-class practice, in which syphilis was transmitted to a patient by using unsterilised forceps in the extraction of a mandibular molar. Care must also be exercised in the choice of the anæsthetic or analgesic, and the one that will be the least dangerous in the particular circumstances, provided that it is efficient, must be chosen. During the operation all care must be taken, and the dentist who tilts the chair back and extends the patient's head is not taking reasonable precautions, especially when the patient is anæsthetised. In the same category comes the choosing of such a general anæsthetic as requires the patient to be lying flat on his back. In both cases there is considerable risk of foreign bodies entering the air-passages. The technique adopted also comes under this heading; for the conduct of the left hand as usually taught and adopted, offers very little protection to the patient.

In this section then, it is necessary to consider some of the ever possible, but fortunately rare dangers associated with the extraction of teeth.

The chief risk to life arises from the proximity of the air-passages. If a general anæsthetic is being administered, both

the dentist and the anæsthetist are responsible ; but it must not be forgotten that in many cases, especially where nitrous oxide is employed, the dentist both operates and gives the anæsthetic.

It has already been insisted upon that the operator should always have at hand the means for performing laryngotomy or tracheotomy, and should be prepared to do it at a moment's notice. Some of the accidents which may require such interference, their causes, prevention and treatment must now be considered.

A tooth or root is relatively a heavy body, and gravity is a great factor in determining the direction in which it goes, if it unexpectedly leaves the blades of the forceps. This is one of the reasons why the Edinburgh School insists on the patient's being in a comfortable sitting posture during the operation with the head in the axis of the body. Then if a root drops, it falls on the anterior curvature of the tongue, and if momentarily lost in the mouth, is nearly always found behind the mandibular incisors. Should the patient be reclining or supine, anything loose in the oral cavity, such as blood, mucus, tartar, a root, or filling tends to fall at once into the pharynx, and if the deglutition reflex is present may fortunately be swallowed and probably do no harm. If on the other hand, the deglutition reflex is absent and the patient breathing vigorously, as happens under nitrous oxide, the glottis is widely opened at each inspiration, and in an adult the space is sufficient for the passage of all the single-rooted teeth and even many molars, and there is great risk of the foreign body being inspired. Similarly, if the patient is deeply enough under chloroform for the mouth to be opened for the performance of the operation, then in such a short operation as the extraction of teeth, the reflexes protecting the larynx will probably be in abeyance throughout, and the patient may be placed in jeopardy from the entrance into the air tubes of blood and mucus, to say nothing of pus and roots.

Again, a tooth may not simply glide out of the blades of the forceps, but may be expelled from them with great violence. In the great majority of cases it shoots forwards, and if the patient is sitting up, flies out of the mouth ; but if the head is thrown back, it naturally has much less chance of doing so. Even the precaution of having the patient sitting up is not always protective, as is shown by the following case, the only one of the kind, however, that I have seen :—

A student was extracting under nitrous oxide an isolated second left maxillary molar, which had moved somewhat forwards. With a loud "click" the tooth flew from the forceps, and with such violence that although I had my eye on it, I could not see where it went—the one thing I knew was that it had not come out of the mouth. The student who was holding the patient's head, immediately bent the body forward at the hips and bent the head on the chest. The patient in this position stopped

breathing, and the prop having remained in place, I was able at once to pass my forefinger into the pharynx, where I could feel the tooth lying transversely behind the epiglottis. Preparatory to trying to hook it forwards, I pushed it sideways with the tip of my finger, when a sudden expiration on the part of the patient expelled it from the mouth. Had the object been a root, the probability is great that it would have passed through the laryngeal opening into the trachea or a bronchus.

It was a case in which every reasonable precaution had been taken, and if anything more serious had resulted, it would have been a most regrettable accident, for which no blame could be attached to anyone.

In ordinary dental practice it may be said that, if nitrous oxide, ethyl chloride, or ether is used alone or in combination or sequence as the general anæsthetic, there is no reason why the patient should not be in the posture advocated in these pages. In fact, considering the total risks of the anæsthetic and of the operation, as well as the after-effects, the sitting posture is enormously safer, even in prolonged etherisation. If during the operation it is found that the condition of the patient requires the horizontal position, it can of course be readily adopted. To indicate how rare this is, however, in considerably over twenty thousand cases where these anæsthetics have been administered to ordinary patients for dental operations by the author or by students under his direction, it has only on three occasions been necessary owing to circulatory complications to resort to the horizontal position. Parenthetically, it may be said that the student administering the anæsthetic is made to feel his responsibility and is taught that nothing is to make him take his eyes off the patient's face or distract his attention from the state of the respiration and circulation—thus dangers are anticipated and forestalled.

It is quite otherwise, however, in the case of the dental surgeon to a general hospital, who will have to extract teeth for patients suffering from medical or surgical disabilities, whose condition renders it a physical impossibility or a danger to life to sit up. Still, even in a general hospital practice, there are very few patients fit to have a tooth extracted, who cannot be put in the sitting posture.

The person who is steadying the head, generally the anæsthetist, should watch the operator very closely and should see, even before the operator can say so, if a tooth has been lost from the forceps. He should *at once* flex the patient's head on the chest and the trunk on the thighs, thus lessening the chance of the tooth being inspired or swallowed, and at the same time letting its dislodgment from the mouth be powerfully aided by gravity. It has already been pointed out that the missing root is usually found on the floor of the mouth behind the incisors. An expert operator, however, will guide the root out of the mouth with the

left forefinger and thumb, should it leave the grip of the forceps before it drops at all. Should the foreign body pass through the isthmus of the fauces, it may lodge :

(1) In the pharynx. If it passes through the pharynx, it may lodge :

(2) In the respiratory passages.

(a) In the larynx.

(b) In the trachea.

(c) In a bronchus.

(3) In the œsophagus, stomach, or intestines.

Before describing the symptoms that may arise from each of these conditions, it may be as well to emphasise the fact that the descriptions commonly given in the text-books are very misleading, when considered from a clinical aspect, and are of an academic rather than of a practical interest. In tooth extraction, the danger of a foreign body in the post-oral passages occurs almost only in general anæsthesia. If a tooth falls into the pharynx of a conscious normal patient, it will probably either be coughed up or swallowed. If, however, the patient is under the influence of an anæsthetic, the effect of a foreign body will depend on several factors besides its mere presence, such as its nature, the depth of anæsthesia, and the physique of the patient.

Thus, in the case related above of the molar which lodged just above the larynx, instead of a violent fit of coughing, dyspnœa, and perhaps pain, which are the symptoms a student always gives when asked about the subject, the only symptom was immediate arrest of respiration, probably due partly to mechanical obstruction.

On another occasion, when administering ether for a surgeon to remove a large naso-pharyngeal polypus, the patient suddenly during the surgeon's manipulations ceased to breathe. The mandible was pushed forward without benefit, so the mouth having been opened, I passed my finger into the pharynx and felt the detached polypus lying over the larynx, and upon its removal respiration was at once re-established.

In another case, when administering a C-E mixture for an operation in which there was profuse hæmorrhage, and in which the surgeon had made preliminary use of cocaine, it became obvious that the patient was gradually getting less and less air into his lungs, and after a thorough swabbing, an enormous clot was recovered from the trachea. In these cases, as in many others, the foreign body simply induced immediate or progressive arrest of respiration, which if not relieved, would have caused asphyxia. It is most important to recognise this fact, as more than one life has been sacrificed, because, owing to the absence of the usually-described symptoms, the existence of a foreign body has not been suspected, and so artificial respiration has been of no avail because of its presence.

If the reflexes are active, *a foreign body in the pharynx*, unless too large, is usually swallowed ; but, particularly if it is light, it may be inspired. During inspiration the glottis is widely open, and the foreign body, if too large to pass through the opening, may lodge on the top of or in the larynx, and if small enough may pass through into the trachea. If small and smooth and heavy enough to pass on, it usually enters the right bronchus which, although less in a line with the trachea than the left, has a larger lumen. The body seldom passes beyond the primary bronchus, but may do so.

A foreign body in the pharynx may, if large enough (*e.g.*, a sponge), cause complete respiratory obstruction—the patient abruptly stops breathing, turns black in the face, and dies suddenly. If the obstruction is incomplete as from a tooth, there may be dyspnœa, pain, dysphagia, or possibly inability to swallow, retching, or actual vomiting, the face becoming more or less livid, and the patient “distressed.” The head and body having been bent forward, the mouth should be widely opened and the forefinger passed into the pharynx at one side. Then the foreign body having been felt, an attempt should be made to hook it forward with the tip of the finger. If this fails in the case of a child, he may be held up by the legs and a vigorous slap given between the shoulder blades, in order to cause dislodgment. In asphyxial conditions, however, there is grave objection to inverting a patient ; for the arrested respiration itself tends to venous engorgement and swelling, which still further narrows the air-passages, and the inverted position markedly aggravates the condition—the patient is therefore better sitting up.

The length of time that one can afford to spend on these attempts depends upon the length of time that the heart can withstand the arrest of respiration. In an ordinary healthy adult, this may be put down at three minutes at the outside, so that if respiration has been completely arrested, not more than two minutes should be spent in efforts to remove the obstruction, before a laryngotomy or tracheotomy is performed. One will be guided far more by the condition of the patient and especially by the state of the pulse than by the watch. An opening into the air-passages having been obtained, artificial respiration must, if necessary, be performed.

Throughout this book the author has attempted to avoid the subject of anæsthetics ; but it is so intimately bound up with the operative procedure for which the anæsthetic is given, that it is impossible to divorce them altogether, and so the following case, in which a large flabby tongue was the cause of serious obstruction, is related, as it illustrates the necessity of **always being prepared with powerful means for separating the jaws :—**

Some years ago I was asked to administer nitrous oxide for a big, very muscular man of about thirty-five years of age for the extraction of a right maxillary third molar. It was the only carious tooth in his head, and the occlusion and interdigitation of the teeth were so perfect as to arouse keen enthusiasm in the dentist and myself—at first. The patient took the anæsthetic satisfactorily until well into the second stage, when he pushed the prop out, snapped his jaws together and stopped breathing. His colour being good, I did not at once remove the facepiece, but the dentist compressed the lower part of the chest firmly. As this did not re-establish respiration, I removed the facepiece and attempted to open the tightly clenched jaws. It was quite impossible to get the blades of the screw-wedge gag in, and I was debating with myself whether to extract, knock out, or break off a tooth in order to get the necessary room, or even whether I might have to open the air-passages, when it occurred to me to try to force in just one blade of the gag. By the use of both hands I was able to do so far enough for the dentist to insert the parallel blades of Fergusson's gag. Withdrawing my blade, I inserted the screw gag in the ordinary way, and between us we were able to prise open the mouth. I passed my forefinger over the enormously swollen tongue until I felt the epiglottis and then made vigorous upward and forward traction. The patient, who was almost black in the face and whose veins in the neck (the collar had been removed) were sticking out like huge cords, immediately took deep stertorous respirations, and before he recovered consciousness I relieved him of his molar. Since this episode, my delight in a perfect occlusion has been somewhat tempered.

A foreign body enters the larynx during a deep inspiration, when the glottis is widely open. If it lodges there, it may completely arrest respiration mechanically, whilst even if its shape, size, or position do not cause arrest, reflex spasm may do so. Total obstruction may cause immediate death, and in partial obstruction there may be dyspnœa, a sense of suffocation, violent coughing, and perhaps vomiting, whilst the respirations become stridulous.

A foreign body lodged in the larynx is practically beyond the reach of the fingers, and requires a laryngoscope and laryngeal forceps for its removal by the mouth. These instruments are not likely to be at hand, nor is the dental surgeon likely to possess the special skill required for their use, so no time must be lost in opening the air-passages below the obstruction. The patient will then be out of immediate danger, and skilled help must be sought for the removal of the foreign body.

An object that is small enough to be inspired through the larynx is not likely to be at first impacted **in the trachea**. If not heavy, it may move up and down with expiration and inspiration, causing a good deal of coughing, pain, dyspnœa, and, especially later on, copious mucous secretion, which will impede its movements and finally bring it to a position of rest. So long as the body is in the trachea, there is no immediate danger, and no attempt should be made to remove it until full preparations have been made for opening the air-passages. The danger is that a possible expiration or cough may expel it into the larynx, where it may cause obstruction to respiration. The patient should

be left alone and allowed to assume the posture that gives most relief, until all preparations have been made.

The operations of laryngotomy and tracheotomy are simple ones, but the circumstances which may call for the performance of one or other of them in dental practice arise suddenly and are apt to be very disconcerting, so that the operator, even if his knowledge of what is required of him is profound, may be in want of that most requisite of all things in emergencies—a cool head. There are no operations in which flurry and undue haste are more likely to defeat their ends than in these, and the fact has been repeated so often as scarcely to require repetition here, viz., that a cool head and a steady hand are far more valuable than accurate anatomical knowledge.

The dental surgeon who extracts teeth should, by consulting one of the larger works on surgery, make himself familiar with the whole circumstances of the operation, its difficulties and its risks. For convenience and to render this section more complete, a short account of the essential features of the operations is given here.

Simpler means of re-establishing respiration, when its arrest is due to obstruction above the trachea having failed, laryngotomy or tracheotomy must be performed. There are one or two factors governing the choice of operation. The more urgent the need, the greater the indication for laryngotomy, but if there be time a high tracheotomy is preferable. Laryngotomy, especially if unskilfully performed, may permanently impair the voice, whilst in children under thirteen or fourteen, this danger and the smallness of the space make tracheotomy the only available operation. The tracheotomy wound is much deeper, there are many veins (now much engorged by the respiratory arrest) over the site of the operation, besides all the immediate and remote risks of inspiring blood into the lungs. It must be remembered that the trachea is very mobile, not only vertically but also laterally. Its walls too, especially in the young child, are very soft and easily compressed, leading to difficulty in finding it unless great gentleness be exercised. Again, after middle life the cartilages may become very hard and even ossified, requiring a strong-bladed knife to divide them. It is important to have some idea of the size of the lumen of the trachea, as this of course determines the size of the tube to be inserted. Most people who have not definite knowledge, believe that the lumen is very much larger than it is. Even at the same age, it varies somewhat in different individuals, but the following figures, which are approximately correct, are easily remembered:—

From 4 to 8 years about 8mm. diameter.

„ 12 to 15 „	„ 12mm. „
Adults	„ 12 to 15mm. diameter.

That is to say, that up to about eight years of age, the lumen has the diameter of an ordinary lead pencil, whilst even in the adult, it is less than twice that diameter.

Although it is a great convenience to have proper instruments and help, many a life has been saved by the timely use of a sharp pocket knife.

The most essential instruments are :—

A scalpel. This should have a shortish blade with a sharp point, and be strong enough to cut dense cartilage, if necessary.

Artery forceps—two or three.

Dissecting forceps.

Laryngotomy and tracheotomy tubes. The tracheotomy tube is circular in section, whilst the laryngotomy one is oval, and flattened from above downwards to allow of its passing between the cricoid and thyroid cartilages.

For both operations, the patient is placed on the floor in the best light possible. The head must be fully extended over a support, placed behind the patient's neck. For this purpose a gas bottle, or folded coat or cushion may be used. The assistant should kneel behind the patient's head and, holding it between his two hands, concentrate all his attention upon keeping the head and neck in a straight line.

Laryngotomy. The operator, kneeling at the right side of the patient, feels for the pomum Adami of the thyroid cartilage and about one inch below it (in the adult) for the cricoid cartilage, immediately above which the opening is made. He steadies the larynx between the left fingers and thumb, taking care not to compress it, at the same time making the skin over it moderately tense. An incision is made strictly in the middle line about one inch and a half in length, with its middle over the crico-thyroid membrane. If the case is urgent, this incision is made down to the membrane at once, and the larynx opened by a short horizontal incision in the middle line, close to the upper border of the cricoid cartilage.

If there is less urgency, after the skin incision has been made, the space between the sterno-hyoid muscles is defined, the muscles and skin retracted, hæmorrhage arrested, and then the larynx opened as described above.

If it is a case of extreme urgency, the upper border of the cricoid cartilage is felt for, and a transverse stab made just above it exactly in the middle line, cutting through skin, fascia, crico-thyroid membrane and mucous membrane at one thrust.

Tracheotomy. As in the case of laryngotomy, the surgeon identifies the thyroid and cricoid cartilages and, steadying the trachea between the fingers and thumb of the left hand, makes an incision about one inch and a half long strictly in the middle line, beginning at the upper border of the cricoid cartilage. The

incision passes through superficial fascia and, especially in children, an abundant layer of fat, exposing the interval between the sterno-hyoid muscles, which are then retracted. The isthmus of the thyroid body which usually covers the third and fourth tracheal rings may, if high up, be pushed down with the handle of the scalpel, after the tracheal fascia along its upper border has been divided. The upper tracheal rings are now cleared with dissecting forceps and the handle of the scalpel, until they can be seen, or at least distinctly felt. Whilst the larynx is still supported with the left hand, a stab is made between say the second and third rings, the edge of the knife being turned towards the chin so that the rings are cut through from below upwards. A deep inspiration usually follows immediately, succeeded by severe coughing, and unless hæmorrhage has been completely controlled, the patient must be at once rolled on to his side.

After both operations, care must be taken when inserting the tube to see that it really is in the lumen of the trachea. If a tube is not at hand, the airway can be easily made patent and kept so by inserting the handle of the knife and turning it at right angles to the line of incision, or a hairpin bent at right angles can be used, the loop being passed into the wound, or a quill toothpick or a piece of small rubber tubing. The cyanosis rapidly disappears, hæmorrhage practically ceases, and the breathing soon becomes quieter. The principal thing is to restore respiration at once, and then skilled help can be waited for, the foreign body removed, the wound stitched up, and after-treatment carried out.

It may happen, however, that respiration does not immediately follow the opening of the air-passages, and then after being satisfied that there is still no mechanical obstruction such as a blood clot or vomit, *artificial respiration must be performed*. Also, if there is still great venous engorgement, *the external jugular vein*, which will be seen standing out prominently, should be cut across and six to eight ounces of blood allowed to escape, as this will greatly relieve the strain on the heart and facilitate the entrance of air into the lungs. If there should be any obstruction from blood clot, it must of course be removed, and as special means will probably not be present, there is no objection, as there is in diphtherial obstruction, to the surgeon's applying his lips to the wound and removing the clot by suction.

To summarise :—

- (1) Do not get excited.
- (2) Keep in the middle line—important structures will not be cut ; and hæmorrhage will be far less severe.
- (3) Do not displace or compress the trachea.
- (4) Make sure that the tracheal mucous membrane is incised and not pushed in before the knife.

Should the foreign body pass through the larynx into the trachea, it may, if small and heavy, drop at once **into a bronchus**. If too large to do so, it may, if light, move about in the trachea with respiration. In any case, there is at once, or when the patient recovers from the anæsthetic, violent coughing, with great dyspnœa, cyanosis, great distress, and a sensation of impending death. If the foreign body remains in a bronchus, the symptoms subside, but may be followed by subsequent attacks of coughing, etc., during one of which it may be coughed up. Soon, however, it tends to get fixed in thick mucus, infection, acute or chronic, supervening. In many of these distressing cases, the patient is believed to be suffering from phthisis, the only evidence wanting being the discovery of the tubercle bacillus.

If the dental surgeon at the time of the operation has any suspicion that a foreign body has passed beyond the larynx, or if the subsequent history of the patient indicates the possibility of such an accident having occurred, steps must be immediately taken to clear the matter up. If the foreign body remains in the air-passages, the patient will certainly die sooner or later, whilst owing to recent developments it can be removed by a skilled bronchoscopist with comparatively little risk and with great certainty—provided only the case is seen early enough. Even within a few hours, the foreign body may cause great secretion of mucus and sufficient swelling and inflammation of the mucosa to make it extremely difficult to find it. The aid of the X-rays should also be invoked.

A most instructive case was recently reported in *The Lancet* of a lady who inspired a small-headed pin into a bronchus. Thanks to the advantages of telegraph, telephone, a motor car, X-rays, the bronchoscope, and skilled surgeons, the body was removed within a few hours of its entrance, and a rapid recovery made.

Should a tooth pass into the œsophagus, it will almost certainly be carried on into the stomach, and in course of time be voided. There need therefore be no anxiety over such an accident. An interesting sequel to a swallowed root, however, occurred in my hospital practice.

A girl had had a number of roots extracted under ethyl chloride, and she subsequently vomited, some of the vomit escaping by the nose. Some days afterwards her nose bled, and the bleeding frequently recurred during the next few weeks. At the same time there was some soreness in the left nasal fossa, and she could not breathe freely through the nose. Several weeks after having the teeth removed, whilst blowing her nose, she expelled a root into her handkerchief. The interesting point was that the patient's mother brought her to me, hoping to get confirmation of her belief that she had grounds for a grievance against the dentist. She believed that the root had been pushed through the palate into the nose; but after hearing the history, I was able to convince her that the root had probably been swallowed and subsequently vomited into the nose.

On a previous page, it has been pointed out that the possible evil results of tooth extraction, both at the time of the operation and subsequently to it, have not been sufficiently realised either by the dental surgeon or by the public, and the sooner this attitude is changed the better.

It is true that severe shock and syncope are uncommon, but the observant dentist must have seen mild evidences of them very frequently. One must give due weight to the physical condition of the patient, the temperament and the past history, in determining one's procedure, even when only one tooth is to be extracted—how much more so then, when an extensive clearance is to be made! For this reason I prefer, when anything more than nitrous oxide is required for anæsthesia, to have the patient properly prepared and to operate at his home, so as to avoid movement and risks of chill and discomfort, and also to see that he gets adequate after-treatment.

Again, one must exercise sound judgment in deciding how much should be done at one time, and an extensive operation, that would be quite justifiable in a strong healthy person, may not be so in one who is weakly, overworked, and profoundly anæmic.

Syncope or fainting may occur before, during, or after the operation, especially if no general anæsthetic is used. The treatment is at once to lower the head, either by bending it down between the knees or by laying the patient horizontally. Any tight clothing around the neck and waist must be loosened. This treatment is usually sufficient; but in more severe cases, the lips should be briskly rubbed with a towel or even with the hand, and smelling salts applied to the nostrils. If this is unsuccessful, the patient's legs and body should be elevated slightly above the level of the head, so that gravity shall determine a flow of blood to the centres in the medulla. The chest may also be laid bare and flicked with a wet towel. In addition, ether (15m) or strychnine ($\frac{1}{40}$ gr.) may be injected subcutaneously, but their value is inversely proportional to the gravity of the case; for the poorer the circulation, the less chance have they of being carried into the circulation and of stimulating the centres. When the syncopal attack is over, the patient should still retain the recumbent posture for a time, and should be kept warmly wrapped up. Supposing the operation has not yet been performed, the question arises whether it should be delayed, and if it is decided to proceed, it may be advisable to operate with the patient recumbent. Cases of fatal syncope have occurred during tooth extraction, even in apparently quite healthy persons.

Shock. Considering how frequently tooth extractions take place, this complication must be admitted to be a rare one, at least in its more severe forms. It undoubtedly does occur,

especially after an extensive operation on a feeble patient. Should a general anæsthetic have been administered, the condition may show itself during the progress of the operation, or during recovery.

The **treatment** is to keep the head low and to apply warmth. The patient should be wrapped in blankets and, if great care be exercised, *warm*, not hot, water bottles may be placed close to, but not touching him. These measures are usually all that are required, and in course of time reaction naturally follows. It is a mistake to over-stimulate; but in severe cases smelling salts may be applied to the nostrils, or if the patient is able to swallow, half to one drachm of aromatic spirits of ammonia may be given in a little water, or a hypodermic of ether (15m) or strychnine ($\frac{1}{40}$ gr.) administered. The pallor, cold sweat, and weak rapid pulse that frequently herald the onset of vomiting may closely simulate shock.

It must be remembered that **shock is largely preventable**, and is conduced to by neglecting the proper preparation of the patient, by the room being too cold, by rough and prolonged operating, by hæmorrhage, and by a too-light anæsthesia.

Hysteria in one of its protean forms may manifest itself after the operation and to the uninitiated may be very alarming. The patient may lie like a log, refusing to be aroused by almost any stimulus, or may indulge in unrestrained emotional outbursts. In dealing with such cases it must be remembered that the patient is not a malingerer and must not be treated as such, but, according to the circumstances of the case, with consideration, firmness, and tact. After operations under a general anæsthetic; I have frequently noticed that the patient has made an excellent recovery, until some kind and sympathetic but foolish friend or relative has been allowed beside her, and then excitement has followed. The treatment is obvious.

Epilepsy. Although I have operated on a fair number of epileptics both with and without a general anæsthetic, I have only twice seen a fit as a complication. In the one case it occurred just as the patient lost consciousness during a nitrous oxide administration, and in the other it immediately followed recovery from nitrous oxide anæsthesia. There is nothing special about the treatment, but, as usual, the patient should be placed in a safe position on the floor, something placed between the teeth to prevent the tongue from being bitten, and the clothing loosened.

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